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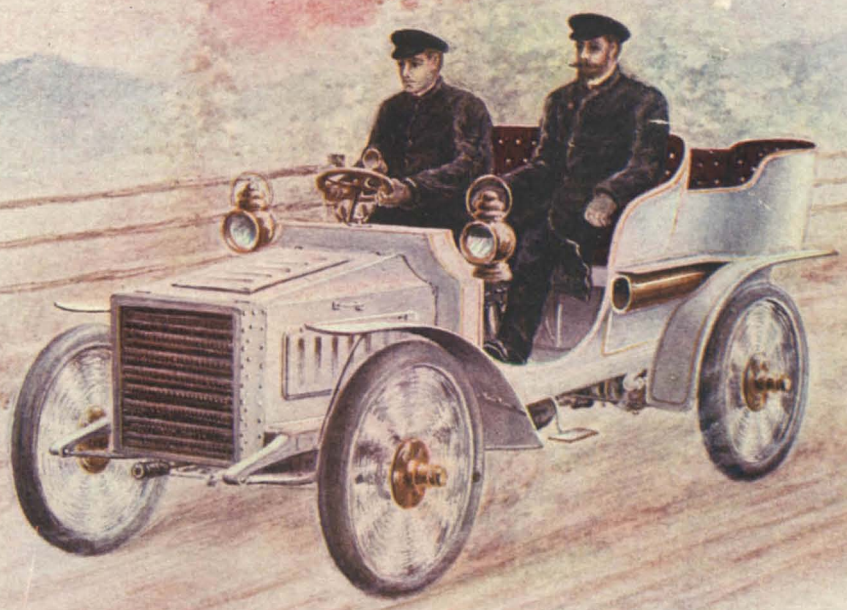

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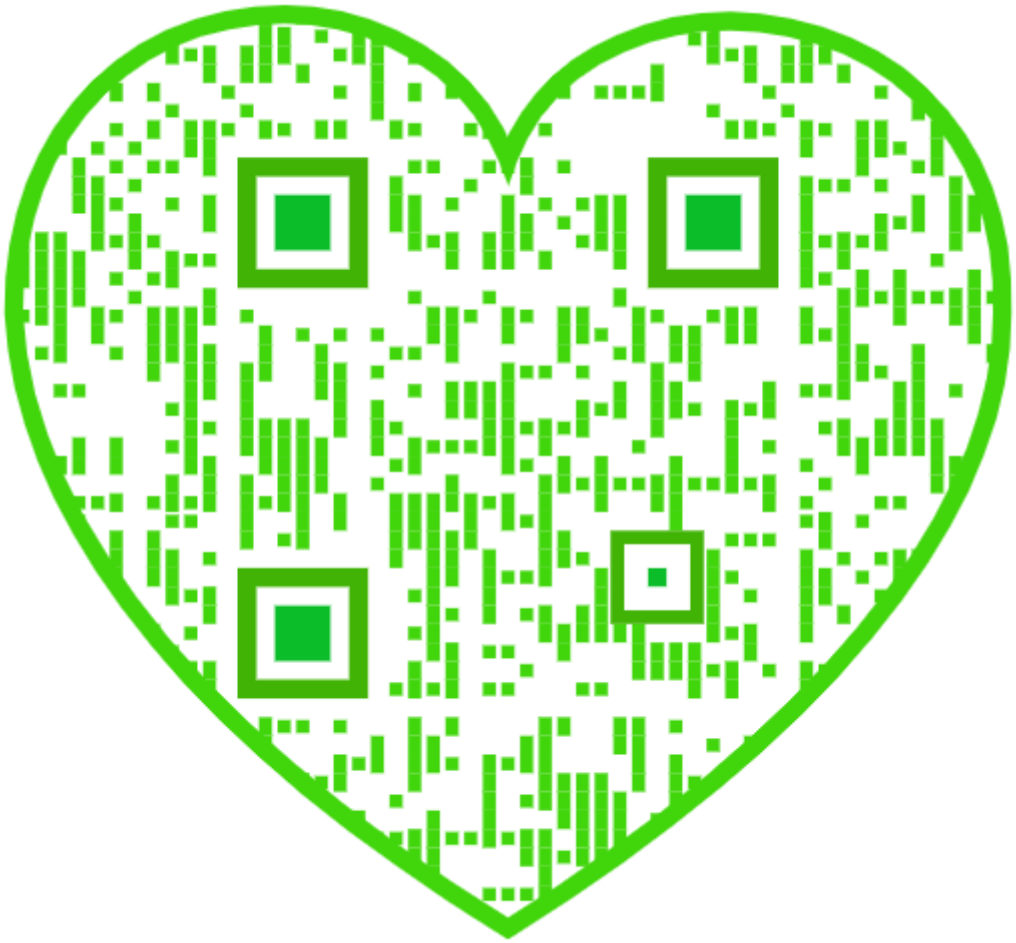

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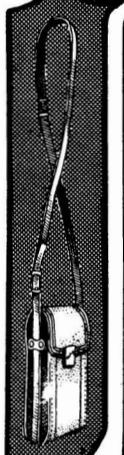

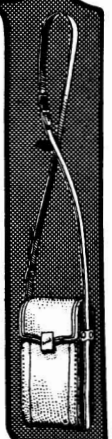

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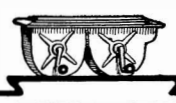

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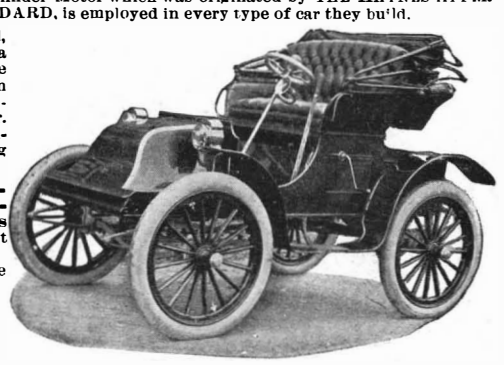

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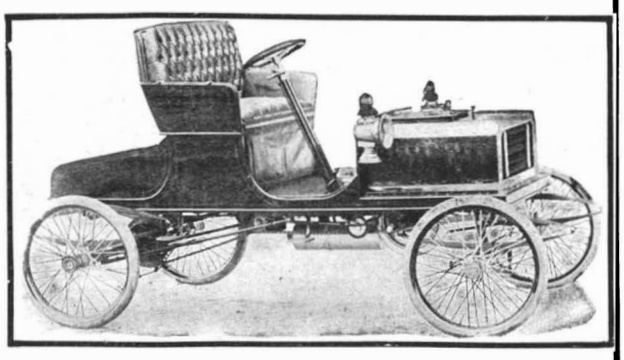

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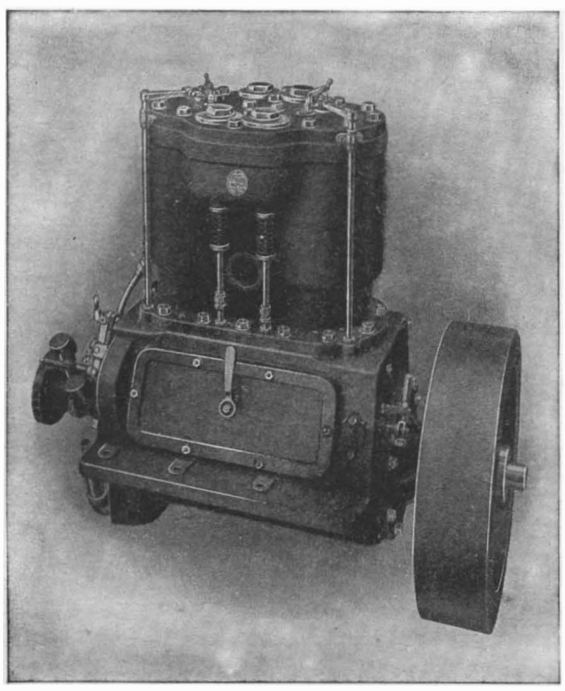

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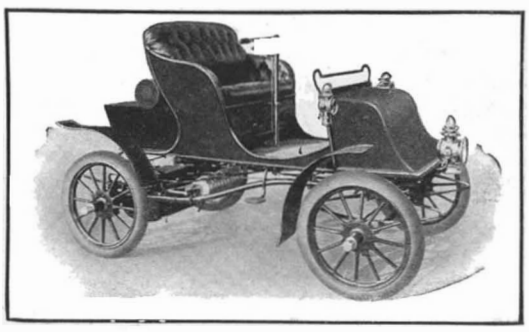

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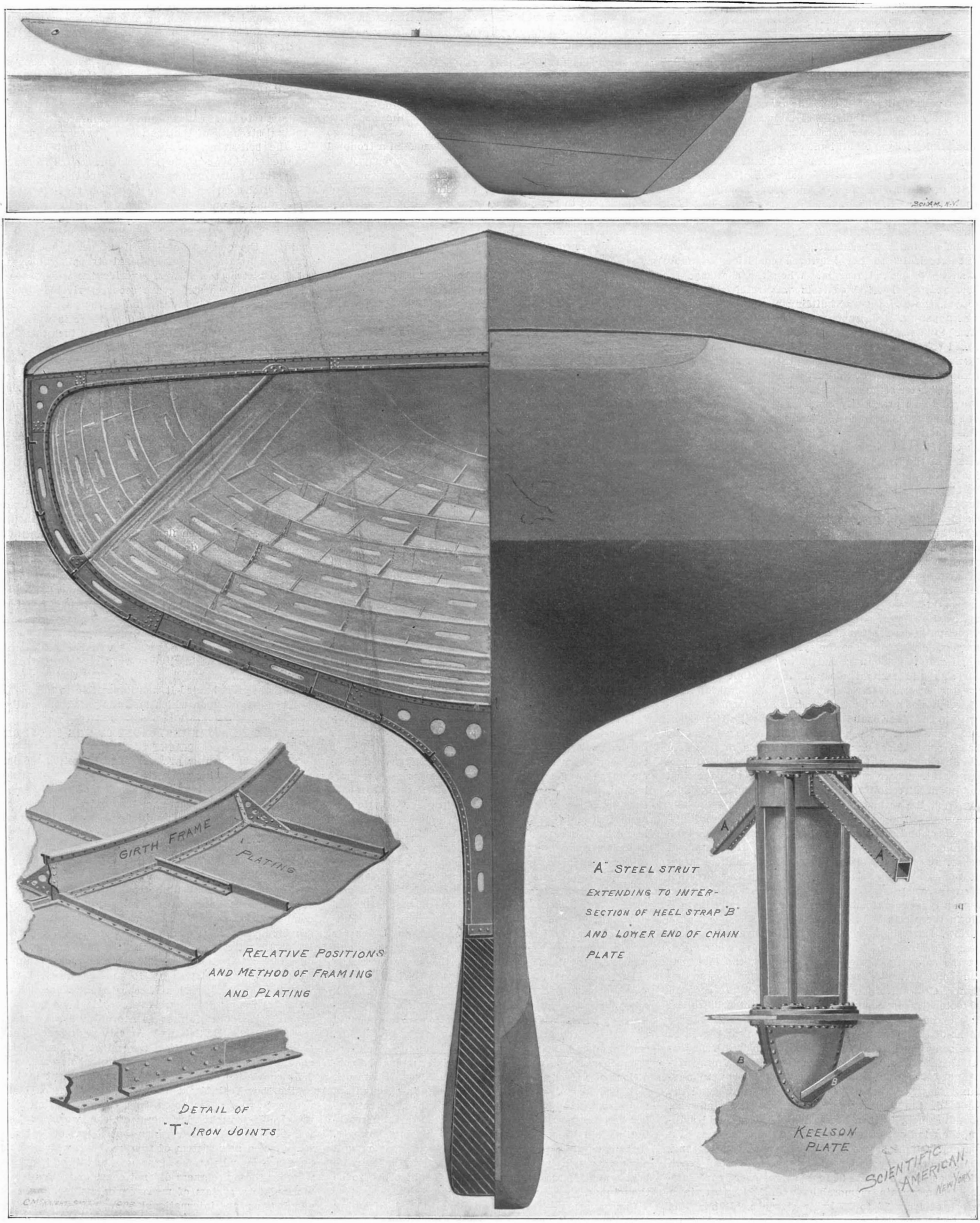

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THE NEW CUP DEFENDER "RELIANCE."

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NEW YORK, SATURDAY, APRIL 11, 1903.

THE NEW CUP YACHT "RELIANCE."

At the close of the "America" cup races of 1901, when the results had proved that the two yachts had come so closely together that the result was largely a question of the accidents of seamanship and weather, it was acknowledged on all hands that their designers had apparently reached the limit of their skill with the type of yacht employed for these contests. Herreshoff, in spite of all the rich store of knowledge acquired in the construction of four previous cup defenders, had been unable in that year to produce a boat superior to his own "Columbia;" while Watson, in spite of the much-talked-of tank experiments, was unable to beat "Shamrock I." in her improved condition, by more than a very small margin. When the challenge for this year's series of contests was received and accepted, the necessity of building a new cup defender was apparent. The supposed superiority of "Constitution" to "Columbia" was at best very hypothetical, and based solely upon the presumably better handling that "Columbia" had received during the trial races. At the same time, in view of the fact that Fife, whose "Shamrock I.," after some readjustment of her sail plan, had proved to be practically equal under many conditions of sailing to "Shamrock II.," had been commissioned to build the new boat, and that in all probability he would succeed in turning out a craft that was faster than either of the two "Shamrocks," it was realized that to insure the retention of the cup a new defender should be built, and that the task of designing and constructing the craft should be given to Herreshoff. This much decided upon, there arose the important question as to what kind of yacht should be built—a question more easily asked than answered. Indeed, "Columbia" had proved such an extremely satisfactory boat, that when it came to the question of the design of "Constitution," Herreshoff made no further change in model than to increase the beam by one foot and enlarge the sail plan to match the greater power of hull thus secured. In construction "Constitution" had some advantages of lightness and strength due to the system of belt-and-longitudinal framing adopted; and it was a source of great surprise and general disappointment that with her greater power, greater sail spread, and general lowering of weights of hull, she did not show any decided superiority to the older boat. It looked as though Herreshoff had done what Watson had frankly declared that he had himself done, namely, exhausted his resources in the development of the conventional type of 90-foot racing yacht. There was no further gain to be looked for in the direction of reduction of weights, nor, judging from the results in "Constitution," was there any advantage in increase of power by increase of displacement and sail area—not, at least, if the same typical midship section was to be retained. If any radical departure was to be taken, experience in smaller classes of yachts had shown that it must be in the direction of the broad, shoal-bodied craft of the modified scow type, a type which had proved to be practically invincible in these classes.

Now, Herreshoff has never in his larger boats appeared desirous of going very far in this direction. At the same time, there is no denying the fact that the bold departure made by the young Boston designer, Crowninshield, when he produced the scow-fin 90-footer "Independence," while it did not achieve the object aimed at of producing the all-round fastest cup yacht of that year or any year, nevertheless served to give some most valuable data and proved to a demonstration that on certain points of sailing, a properly-designed 90-foot modified scow was faster than anything afloat. Although "Independence" showed all the faults of the scow type when going to windward, pounding heavily in a breeze and head sea, and spilling the wind out of her sails under the conditions of a sea and a light breeze after the manner of all beamy shallow craft, she had proved that on a broad reach she was the fastest 90-foot sloop ever constructed. On a certain memorable day off Newport, in a breeze of from 17 to 25 knots strength, although, as was to be expected, she was beaten by "Columbia" on the windward leg, she overhauled that boat (herself remarkable for her reaching qualities) at a pace which gave reason to believe that were "Independence" properly tuned up, she would, with all her faults to windward, have proved more than the master of "Columbia" or "Constitution" on a triangular course in a wind of any strength. Her performance in reaching made a profound impression upon the amateur element among those who are intimately connected with the defense of the cup; an impression so strong that when the cup yacht was ordered, it was made a *sine qua non* that she should embody some of the best features of the "Independence" type. And right here, it is but just to Mr. Crowninshield to acknowledge the most important contribution he has made to the defense of the "America" cup; for it was pretty safe to say that had "Independence" not been built, the defense of the cup this year would never have been intrusted to a vessel of the extreme type which is now being built at the Herreshoff yards.

The problem, then, before the Bristol designer was to produce a yacht with all the best features of the scow type, such as great sailing length when heeled, and large sail-carrying power, with as few as possible of the scow's drawbacks, such as the flat floor forward and the hard shoulders which helped so greatly to the undoing of "Independence" in a troubled sea. And this Herreshoff has achieved, if we may judge from the model of "Reliance," although with what measure of success will never be known until the boat commences to toy on some calm day with the left-over disturbance of a yesterday's blow. The new boat has more beam and considerably less dead rise than "Constitution," a harder bilge and longer ends, particularly in the forward overhang. Her extreme beam is 25 feet 8 inches; her draft, 18 feet 9 inches; and her length over all, 140 feet. In her midship section she shows exactly 2 feet less dead rise than "Constitution," and while her hull is not so shallow as that of "Independence," it is still sufficiently shallow to allow the ends to be carried out to give practically the same length on deck as the Crowninshield boat. While she will thus secure something of the same long, flat floor, she differs from "Independence" in the fact that the fullness of her bilges, as shown in the midship section, is not carried out into the forward overhang, as was done in the Boston boat, the sections from the water-line at the stem to the bow being something of a compromise between the almost semi-circular sections at the water-line of "Shamrock II." and the decided V-sections of "Columbia" and "Constitution." While there is some loss of power in this modification, there will be a decided gain in easiness in a seaway, especially when the seas are short; and while the new boat will pound somewhat heavily under these conditions, she is not likely to take the bit in her teeth, as did "Independence," and run wild under a freshening breeze or in sudden puffs. Although the draft is less than that of "Constitution," the keel is longer and the bulb is drawn out to finer lines. The mast relatively to the load-water line is stepped in the same position as in "Constitution," and with her 100 tons of lead in the keel, her harder bilges, greater beam, and greater length of water-line when heeled, she will naturally possess larger sail-carrying power; she will spread in the neighborhood of 15,000 square feet of canvas.

It is a curious fact that, broadly speaking, the English designers are working on opposite lines from those outlined above. The new Fife boat, as compared with the two "Shamrocks," will have a deeper body, considerably more dead rise, greater fullness in the garboards, and somewhat less overall length, the model thus reverting somewhat to the type of "Valkyrie II." and "Britannia." Hence, for the second time in the history of these cup races, the American and British designers have crossed each other, our boat running to great beam, shoalness of body, and large wetted surface and the English craft tending to greater fullness of body, large displacement, and a small wetted surface. Should both boats come up to the designers' expectations and prove to be a success, the outcome of the races will depend, more than it has for several years past, upon the conditions of wind and weather. In light breezes and troubled water the advantage should lie with "Shamrock III." Also when "split open," that is running dead before the wind, with spinnaker set, the larger displacement and finer-lined Fife boat, with her smaller wetted surface, should prove to be the faster both in light winds and strong. On the other hand, on a triangular course, where there is much reaching to be done, especially under the conditions of a strong breeze and a smooth sea, "Shamrock III." should be hopelessly beaten, while in a rough sea and strong wind, and under any conditions where reefing becomes necessary, the advantage, except in reaching, should lie with the Fife boat. Seeing, however, that moderate winds and fairly smooth seas prevail during August, it would look as though the extreme boat which Herreshoff is building should prove to be the winner.

CONSTRUCTION.—The belt-and-longitudinal framing that Herreshoff used in "Constitution" proved to be so successful, that it has been adopted practically without any change in the new boat. This system was elaborately described and illustrated in the SCIENTIFIC AMERICAN of May 11, 1901, and the reader is referred to that article for the details of construction. Broadly speaking, the framing of "Reliance" consists of nickel-steel belt frames of deep section, which are spaced 6 feet 8 inches apart, the frames occurring at every fourth station of the eighty-four stations which make up the full overall length of the yacht. These frames extend entirely around the interior of the yacht, and embody the floor plates, frames, and deck beams in one. They are deepest where they form the floor plates, and they become shallower as they run up through the bilges to the deck beams. The hull plating, which is of Tobin bronze and nickel-steel, is laid on in seven strakes with flush joints; the first six strakes are of bronze and the seventh or sheer strake is of nickel-steel. In addition to the belt-framing there is a series of longitudinal frames consisting of alternating T-irons and bulb angles. The T-irons are laid along the seams to which they are riveted, while the bulb angles extend longitudinally midway between the seams, and serve to give additional stiffness to the plating and to reinforce the longitudinal strength of the boat. To prevent the buckling of the belt-frames, a series of plate-steel knees are worked in between the frames and the T-irons, the knees being placed on opposite sides of the belt-frames, that is, one series of knees being on the left side of the frame on one T-iron, and on the right side of the frame on the next T-iron. In a vessel of the great deck area of "Reliance," especial attention must be paid to the question of lateral stiffness; and this is provided by a system of diagonal strapping consisting of 5-16 nickel steel straps, covering the whole area of the deck. These straps are securely riveted to each other where they intersect, and at the partners where the mast passes through the deck there is worked in a diamond-shaped plate of steel ⅜ of an inch thick and measuring 4 feet on the side, which is riveted to the strapping and serves to hold the heavy collars which form the mast partners. Over the strapping thus formed is laid a continuous deck of aluminium plating. The mast-step will be of the same general construction as that of "Constitution." It is formed by deepening the keelson to a depth of 4½ feet, by adding an additional belt-frame and by considerably deepening the foot-plate portion of these frames in the wake of the mast. At the partners there will be two heavy collars, one above and one below the steel deck plate, the upper one being formed of a 6 x 6 inch angle iron, 1 inch in thickness, and the lower of a 6 x 12 inch angle iron also 1 inch in thickness. The 6-inch flanges of these collars will be riveted to the steel deck plate by rivets which pass entirely through from collar to collar. Four heavy, vertical ties also extend from the deck to the top of the mast step where they take hold of the collar which forms the actual footing for the mast. The construction at the mast is also greatly stiffened by a pair of heavy struts of box section, which extend from the mast pardners to the bilges. It will be noticed that the construction is in general very similar to that of "Constitution," whose hull was so stiff that when the vessel was close-hauled it was impossible to tell by the bulkhead doors upon which tack the yacht was sailing.

THE NEW MEASUREMENT RULE OF THE NEW YORK YACHT CLUB.

There has been a growing dissatisfaction of late years among yachtsmen with the type of boat which has been developed under the rules of measurement that govern yacht racing. Not only has the construction of yachts been pushed to such an extreme of lightness that broken spars and leaking hulls are becoming increasingly common, but the form of the yachts themselves has gone to such extreme proportions that the racing machine of to-day is not only costly to build, troublesome to handle and subject to rapid deterioration, but its construction and model combine to render it about the very worst kind of seagoing craft that could be designed. As a cruiser it is pre-eminently uncomfortable and unsafe. The question of developing a rule of measurement under which it would be possible to produce a yacht that would be both speedy and comfortable, one which, when its racing days were over, would have before it a long term of usefulness as a cruiser, has been agitated both by British and American designers, and they have been in practical agreement that something should be done to produce a more wholesome type. This conviction took form in the appointment in 1902 by the New York Yacht Club of a Committee on Measurement, whose first step was to send a letter to the leading yacht designers of the world, asking whether they did not consider that it was desirable to formulate a new system of measurement, which would "produce a wholesome type of boat," and asking whether these designers did not consider it possible to "formulate a system of measurement which might be adopted as an international standard." The letter requested that suggestions should be sent in as to what system of measurement should be adopted. The replies received were unanimous in agreeing that it

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was practicable to formulate the desired rule, and that displacement or its equivalent should be incorporated as a factor in the rule of measurement adopted. As a result of the discussion thus opened up, it developed that there was a practical agreement on the three elements of length, sail area, and displacement as those which should enter into the question of measurement, and the rule as finally adopted by the Club is as follows:

$$\text{Rating measurement} = \frac{L \times \sqrt{S.A.}}{5\sqrt[3]{D}}$$ or the length multiplied by the square root of the sail area, and divided by five times the cube root of the displacement.

Now the development of the racing yacht under the old rule, in which the length of the waterline was added to the square root of the sail area, and the result divided by 2, had led to the production of an extremely undesirable type of boat, it having been found that the very fastest type of craft built under this rule was an unballasted scow—a broad, shallow, box-like structure with its under-body slightly curved longitudinally, so that when measured it would float on an extremely short water line, and when heeled to a breeze would lengthen out to something like double that waterline, using the windward portion of the hull with the crew crowded on the windward rail as ballast to enable the craft to carry its abnormally large sail spread. The most outrageous instance of this development is an extraordinary freak known as "Outlook," which was built for the defense of the Quincy cup. This craft, which is called a 21-footer, is 52 feet 7 inches in length on deck, 16 feet in extreme beam, has a draft of hull of only 8 inches, and yet has a sail spread of 1,800 square feet. This boat (*sic*) proves what may be done under a faulty rule, that is a rule that is not sufficiently comprehensive, when a clever designer sets out to build the most extreme boat possible under that rule by breaking the spirit without breaking the letter of it.

Broadly speaking, the adoption of a rule which took cognizance merely of length and sail area, was based upon sound scientific principles; for length is the chief determining factor of the resistance of the vessel, and sail area of her power. Other things being equal, the longer vessel will be faster than the shorter one, and the vessel with the larger sail area will have the greater driving power. Building under this rule it was soon found that of two vessels of equal waterline length, the beamy boat of shoal draft with a hull of small displacement was faster under the average weather conditions than a boat with moderate beam, greater draft, and larger displacement. Moreover, if a shallow hull was adopted, it became possible to carry out the overhangs of the boat to an excessive length, and by maintaining the hard turn of the bilges in the sections as they ran out into the overhangs, it became possible to greatly lengthen the waterline as the vessel heeled down to a breeze. Consequently a 21-footer, like the "Outlook" mentioned above, became, to all intents and purposes, when she was heeled, a 40-footer, the great stability due to her extreme beam and lengthened waterline enabling her to carry the rig that would ordinarily appear on a 40-foot yacht.

Although the New York Yacht Club rule is not likely to be applied to any boats under 30 feet in length on the waterline, we have chosen for comparison the two 21-footers, shown in the accompanying diagram, for the reason that the full data regarding these boats was accessible. The "Arbeeka" is a 21-foot knockabout, designed in 1898 by Mr. Crowninshield, at a time when the craze for extreme proportions and the tendency to run to the freak type had not made itself felt in what was known as the knockabout class. She is a moderate boat, with easy sailing lines, a good-sized displacement, and a snug sail plan. The other 21-footer, "Don," built in 1901, shows the rapid development toward the extreme type which had taken place in the brief period of three years. She was designed by Mr. Mower, and in the season's racing she had a brilliant career, proving to be practically invincible and winning by very large margins. It will be seen at once that though she is nominally a 21-footer and to that extent in the same class as "Arbeeka," she is actually a very much larger and more powerful craft. When she is heeled to a breeze her sailing waterline is from 28 to 30 feet in length, and with her 600 pounds of live ballast in the shape of the crew strewn along the weather rail, she is well able to carry her 811 square feet of sail even in a pretty fresh breeze. The abnormal sailing length is due to the great length and fullness of the ends. We have traced the designs of the two boats, one over the other, so as to show graphically how the New York Yacht Club's rule of measurement, if it were applied to them both, would give to the more wholesome type of boat a handicap so liberal that the faster boat could never cut it down.

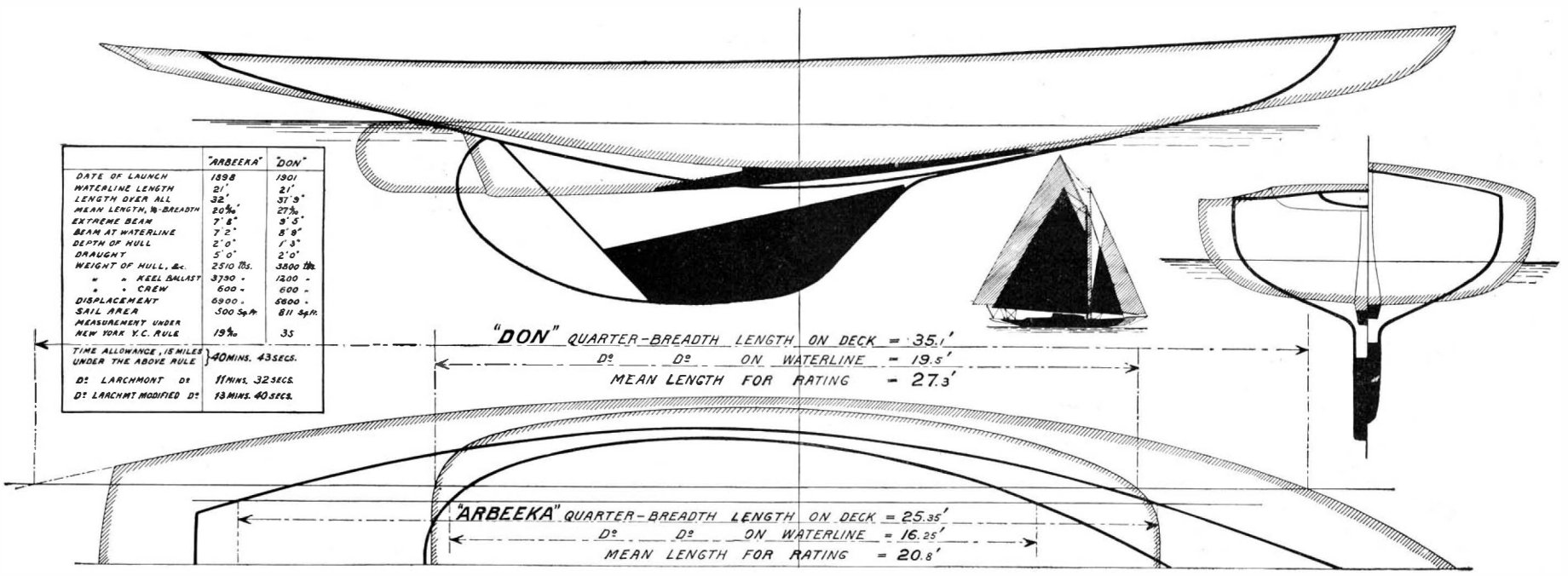
In the new rule the length is no longer measured on the middle vertical plane of the vessel, but on a vertical longitudinal plane taken at one-quarter of the greatest beam at the load waterline, and it is obtained by measuring the length in this plane at the waterline and on deck, adding these together, and dividing by 2, which gives the mean length on the quarter breadth. By looking at the plan of the two yachts, it will be seen how greatly the full waterlines of "Don" and her long overhangs contribute to her high rating of 35, while the sharper waterlines and moderate overhangs of "Arbeeka" assist to reduce her rating to less than 20.

It should be explained that the rule states that in case the width of the stern on deck exceeds one-half the greatest beam at the load waterline, the measurement for the length on deck shall be taken to a point aft of the stern where the continuance of the fair line of the top edge of the plank-sheer would intersect the quarter-beam line. This tends to keep down the broad overhanging sterns that are so much in vogue, and causes "Don" to add several feet more to her deck length. Not only is the extreme boat penalized for length, but also for sail area and displacement. Of sail area it is not necessary to say anything here; but regarding displacement it may be mentioned that it is in this respect that the extreme craft is subjected to one of her heaviest penalties. A shoal, broad boat is of relatively light displacement compared with a boat of deeper body, and since the deep-bodied and large-displacement craft is a better sea boat, has better accommodations, and gives greater comfort generally, displacement has been brought into the rule by making it a divisor of the results obtained in measurement of the length and sail area. In the case of such a yacht as "Don" the penalty is simply enormous and quite prohibitive—her measurement working out as 35 against 19.6 for "Arbeeka," with the result that she would have to allow "Arbeeka" about 2¾ minutes per mile—something which even such a flier as "Don" could not do with any possible chance of winning.

The new rule, as we have said, will probably not be applied to boats under 30 feet in length, and in the case of the larger yachts of extreme form, the penalties, though very heavy, will not work out at such an absolutely prohibitive figure as shown above. The weak point in the rule, if it has one, is the very large displacement divisor, and we think it will probably be found, after one or two seasons' racing, that it will be advisable to take say three times the cube root of the displacement, instead of five times, as the divisor.

It is interesting to note the effect which the new rule will have on existing yachts: Thus "Columbia," whose rating under the old rule was 102, under the new rule becomes 131. The 70-footers "Mineola" and class, which are more extreme in model than "Columbia," have increased in measurement from 76.34 to 90. The most interesting comparison is that between last year's extreme racing yacht, "Neola," which measures 51 feet on the waterline, and the Fife boat "Isolde," which measures 59.7 feet on the waterline. The "Neola" is the most extreme, and for her size the fastest, large cutter that has been built to date. The "Isolde" is a large-displacement, deep-bodied, easy-lined craft of moderate sail plan, and is practically the type which the New York Yacht Club rule is expected to produce. The 51-foot "Neola," whose rating measurement is 60 under the old New York Yacht Club rule, measures 73 feet under the new rule; whereas the 60-foot "Isolde," which measured 60.5 feet under the old rule, measures practically the same, or 61 feet under the new rule. Or in other words, the 51-foot yacht under the new rule has a measurement 12 points higher than that of the 60-footer. It will thus be seen that the new rule, even in the larger classes, bears very heavily upon the extreme craft that have been turned out during the past two or three years.

For the sake of comparison, we have shown the allowance which "Don" would have to give "Arbeeka" under the Larchmont-Hyslop rule, which is used by the Larchmont and Seawanhaka clubs, and under what is known as the modified Larchmont rule, which has been adopted by the Long Island Sound Yacht Racing Association. Under the Larchmont rule, measurement is made of the waterline length; the sail area; the breadth taken at the greatest breadth and at an eighth of the distance from the forward and after points of waterline measurement; the depth; and the midship section—the difference between the two rules being that in the Larchmont rule 31-3 of the midship section is taken, and in the modified Larchmont rule 3.85 of the midship section. Both rules are favored by those designers who have done most of the work in the development of racing craft in the smaller classes, and they claim that the modified Larchmont rule would promote a type of vessel that conforms more closely to the typical American model than would the New York Yacht Club rule, which, because of the big displacement factor, will tend to produce a big-bodied vessel with moderate overhangs, and excessive displacement, conforming more to the typical British cutter.


"DON" QUARTER-BREADTH LENGTH ON DECK = 35.1'
Dº Dº ON WATERLINE = 19.5'
MEAN LENGTH FOR RATING = 27.3'
"ARBEEKA" QUARTER-BREADTH LENGTH ON DECK = 25.35'
Dº Dº ON WATERLINE = 16.25'
MEAN LENGTH FOR RATING = 20.8'

	"ARBEEKA"	"DON"
DATE OF LAUNCH	1898	1901
WATERLINE LENGTH	21'	21'
LENGTH OVER ALL	32'	37'9"
MEAN LENGTH, ¼ BREADTH	20⅝'	27⅓
EXTREME BEAM	7'8"	9'5"
BEAM AT WATERLINE	7'2"	8'8"
DEPTH OF HULL	2'0"	1'3"
DRAUGHT	5'0"	2'0"
WEIGHT OF HULL, &c.	2510 lbs.	3800 lbs.
" " KEEL BALLAST	3790 "	1200 "
" " CREW	600 "	600 "
DISPLACEMENT	6900 "	5600 "
SAIL AREA	500 Sq. ft.	811 Sq. ft.
MEASUREMENT UNDER NEW YORK Y.C. RULE	19⅘	35
TIME ALLOWANCE, 15 MILES UNDER THE ABOVE RULE	40 MINS. 43 SECS.	
Dº LARCHMONT Dº	11 MINS. 32 SECS.	
Dº LARCHMT MODIFIED Dº	13 MINS. 40 SECS.	

DIAGRAM SHOWING THE EXTENT TO WHICH THE N. Y. Y. C. NEW RULE OF MEASUREMENT TAXES THE EXAGGERATED PROPORTIONS OF A MODERN SCOW-TYPE RACING CRAFT.

THE HOME OF THE NEW YORK YACHT CLUB.

The famous yacht club, of whose beautiful home on 44th Street, in this city, we present a series of photographs, is perhaps best known both here and abroad because of the remarkable series of contests, extending over a period of more than half a century, which have been carried on under its auspices for the possession of the "America" Cup—undoubtedly the most famous yachting trophy in the history of sport upon the sea.

Among the names that call for prominent mention in any reminiscences of the New York Yacht Club, none is more widely known than that of Commodore John C. Stevens, for it is

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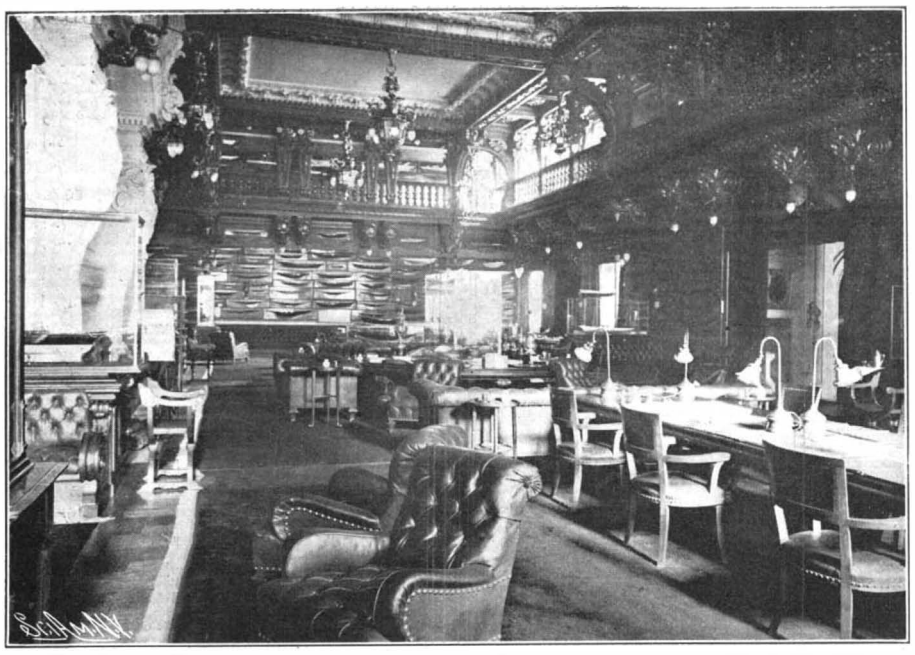


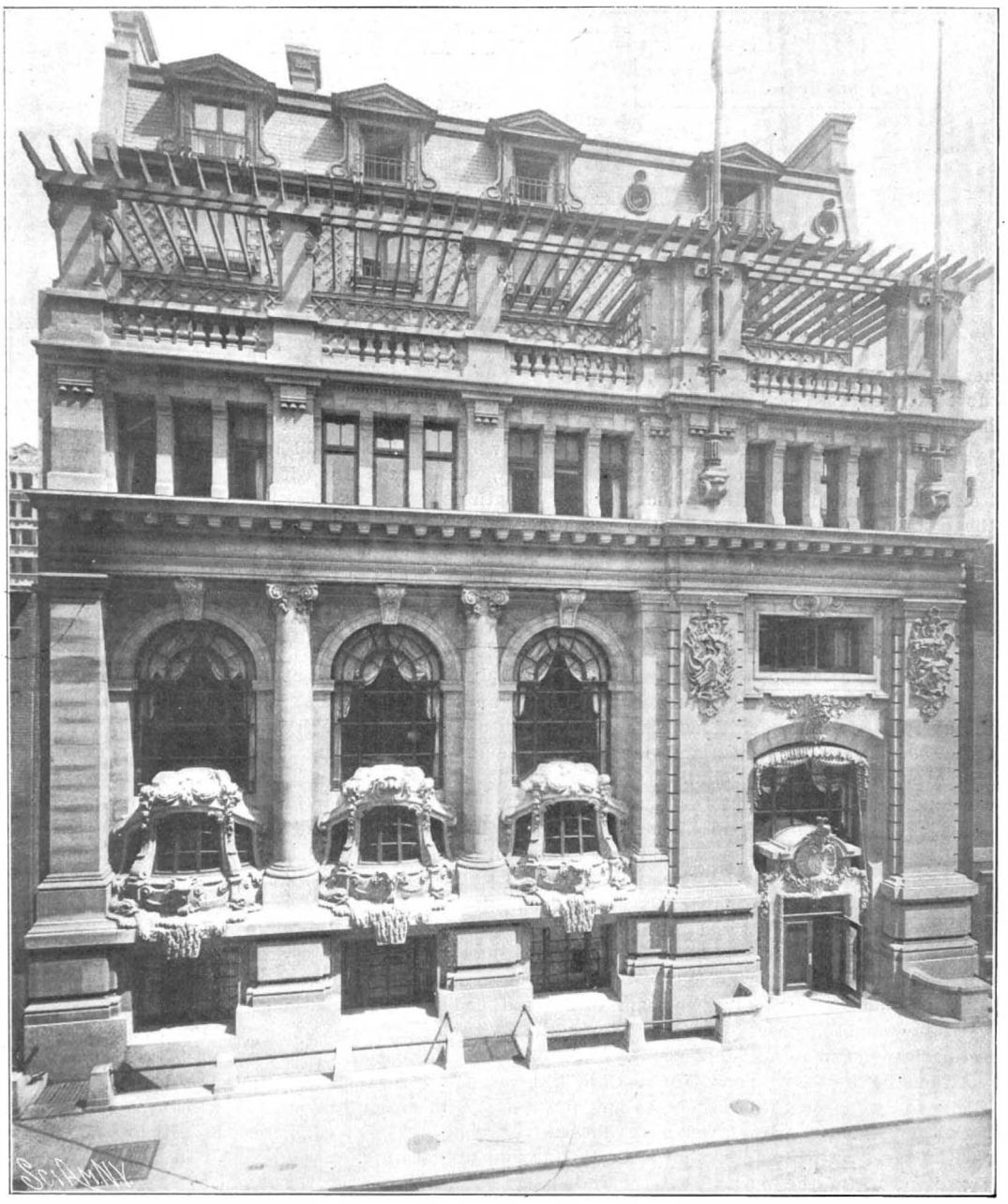
The Spacious Model Room; 96 Feet Long, 48 Feet Wide and 26 Feet in Height.

The Grill Room, Built to Represent the 'Tween Decks of a Wooden Ship.

Ornate Fireplace and Mantel in the Model Room.

The Main Staircase.

Photographs made especially for the Scientific American.



The Facade of the N. Y. Y. Club House.

THE HOME OF THE NEW YORK YACHT CLUB.

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to his initiative, and to the fact of his early association with Mr. George Steers, the designer of many successful pilot boats, that we owe the laying of the keel of the schooner yacht "America." It was after talking over the scheme with Hamilton Weeks, George L. Schuyler, James Hamilton, and J. B. Finlay, that the Commodore and his friends—prototypes of many a later "cup syndicate"—told Steers to go ahead and build a schooner that should make the transatlantic passage and try conclusions in their own waters with the British yachts. Commodore Stevens joined the yacht at Havre, and—well, not to repeat the details of an oft-told story—he brought back a curiously-wrought-and-fashioned silver flagon, that has since acquired a world-wide fame of which the gallant commodore and his friends little dreamed.

Commodore Stevens, who had held the position of chief flag officer from the year 1844, in which the club was organized, resigned in 1855, and he was succeeded by his brother, Edwin L. Stevens. The "America" Cup, which was won on August 22, 1851, was presented by the surviving owners, in 1857, to the New York Yacht Club as a perpetual international challenge cup. *Hinc illæ lachrymæ.*

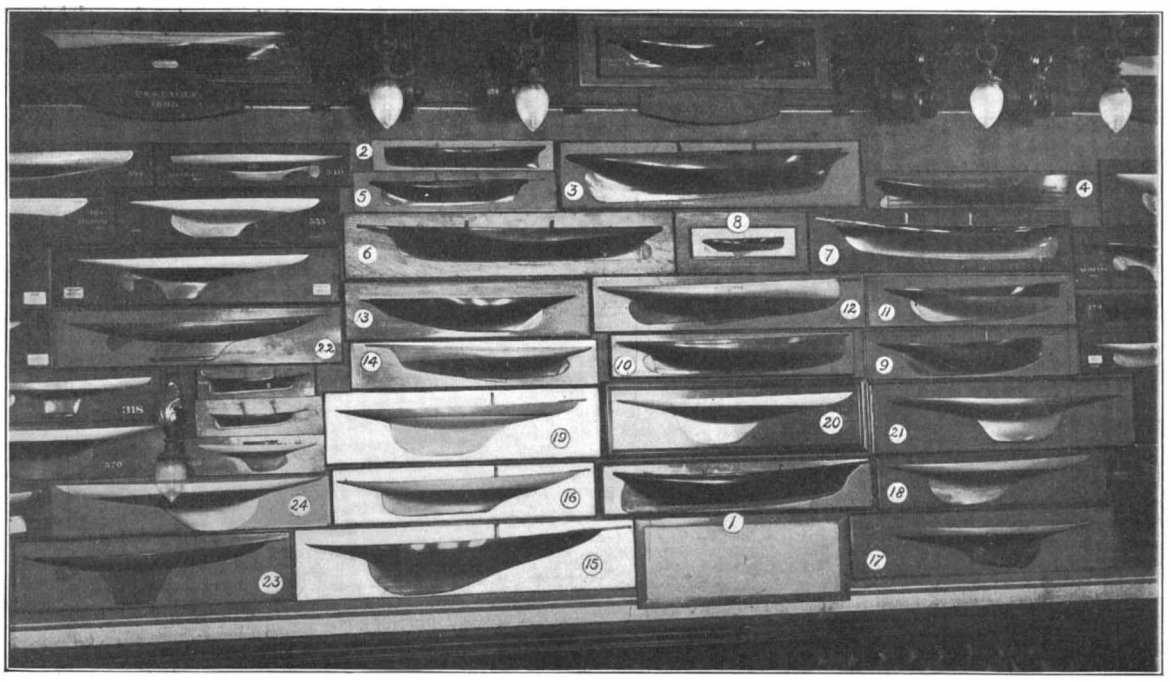
But it is of the home of the club that the present article is to treat; and for the first club house we must go back to the year 1845, cross the Hudson River, and find the Elysian Fields, located north of Castle Point, Hoboken, where in a very modest way in a quiet little house the members met for the first time in their own club house.

At that time there were 122 members in the club, and only a dozen yachts were entered on its roll. Here the club remained for twenty-three years, or until June, 1868, when a move was made to Clifton, Staten Island, which remained the headquarters of the club for three years. In 1871, another transfer was made to the corner of Madison Avenue and 27th Street; and thirteen years later, on May 1, 1884, the club made another move, this time to 67 Madison Avenue, which it occupied for a period of eighteen years, or until it entered into possession of its present magnificent home.

The new club house is located on the north side of 44th Street midway between Fifth and Sixth Avenues. It stands upon a lot 100 feet deep and with 75 feet frontage, which was presented to the club by ex-Commodore J. Pierpont Morgan, one of the most enthusiastic members of the club and the present owner of the famous cup yacht "Columbia." The building itself cost $350,000, this sum not including any of the elaborate and expensive furnishings. As will be seen from the accompanying illustrations, which were taken specially by the SCIENTIFIC AMERICAN, through the courtesy of Mr. G. A. Cormack present secretary of the club, the club house was designed to harmonize, both in its architectural motive and in its accommodations, with the special uses to which it was to be put; and it will be generally agreed that in carrying out the work the architects, Messrs. Warren & Wetmore, have produced an extremely pleasing and satisfactory result. The facade on 44th Street has a total height of five stories, the three lower stories being carried up flush with the building line, and the front wall of the two upper stories being carried back to form a broad balcony which is roofed in with open rafters. These, in the summer season, are covered with trailing vines and afford a striking, but not unpleasing, skyline to the facade. The building as viewed from 44th Street, presents a dignified, and at the same time highly picturesque effect, the last feature being heightened by a very novel but effective treatment of the three main windows of the second floor, the lower third of which has been designed to reproduce the stern lights of an old Spanish galleon. And remarkably well does the device blend with the general architectural treatment.

The building is entered from the street level through a richly-carved doorway, that leads into a large and lofty hall. Immediately to the left is a small reception room, on the walls of which are some superb photographs of international yachts, notably "Columbia" and "Shamrock II." Also to the left of the hall is the entrance to the famous grill room, and to the billiard room and café. The grill room, which measures 30 feet by 68 feet, is an unique feature in this very handsome building. It is entered by a few steps that lead down from the hallway, the room itself being somewhat below street level. Particular interest attaches to it from the fact that it has been built and fitted out to reproduce, as far as possible, the 'tween-decks of an old wooden sailing ship. The floor is deck-laid and the frames and deck beams are reproduced with fidelity, the illusion being greatly enhanced by the crowning of the deck beams and by the fitting of hanging knees complete with their bolts, etc. The dark oak furniture has been designed to harmonize with the room and the whole effect is both artistic and ship-shape. From the entrance hall access is had to the second floor by a broad marble staircase, the balustrades of which are richly carved in conventional marine designs. Directly opposite the staircase is a circular breakfast room, with a domed roof, while to the left a doorway gives access from the landing to the large model room. This noble hall (for it is nothing less) has the generous proportions of 45 feet width and 96 feet length, with a clear height of 26 feet to the roof, which is enriched with deeply carved beams and a cathedral-glass skylight.

This room is the pride of the club house, and justly so. It is furnished in dark oak. The elaborate carving and the dark leather upholstering, combined with the quiet tone of the color scheme, give the room a particularly rich and restful atmosphere. A continuous wall seat, broad and leather-upholstered, extends around the walls, while above this the walls are covered with what is probably the largest single collection of yacht models in the world, there being nearly five hundred in all. Above the models is a broad gallery carried on heavily carved brackets, and the gallery wall is also covered with models, although there is still space left for a considerable addition in the future. A very impressive feature of the room is the massive mantel of stone which stands in the center of the west side of the room opposite the entrance. Distributed throughout the room are various glass cases containing completely-rigged models of yachts; and arranged in various convenient positions throughout the room are curios and mementoes, several of them being of the late Spanish war. Another room of which the club members are justly proud is the library, which measures 32 x 46 feet, while adjoining it is a 28 x 34 foot chart room. Both of these rooms are well lighted and extremely comfortable; in fact, the sense of comfort, which should be a *sine qua non* in every club house, is the most conspicuous impression that one carries away from this superb building. Not by any means the least interesting room is the committee room, where important matters affecting the international yacht club races are debated and determined upon. The New York Yacht Club has grown in the half century or more of its existence at an astonishing rate, particularly in the past ten or fifteen years, the total membership upon the rolls of the club being now about two thousand.



1. America.
2. Magic.
3. Cambria.
4. Madeline.
5. Livonia.
6. Columbia.
7. Sappho.
8. Mischief.
9. Genesta.
10. Puritan.
11. Galatea.
12. Mayflower.
13. Thistle.
14. Volunteer.
15. Valkyrie II.
16. Vigilant.
17. Valkyrie III.
18. Defender.
19. Shamrock I.
20. Columbia.
21. Shamrock II.
22. Jubilee.
23. Pilgrim.
24. Constitution.

REMARKABLE GROUP OF CUP YACHT MODELS.

A GROUP OF FAMOUS YACHT MODELS.

Probably the most numerous, and certainly the most interesting, group of yacht models in the world, is that which adorns the walls of the New York Yacht Club, where not far short of five hundred models of yachts are to be found. The special interest of this collection is to be traced to the fact that a large proportion of the models are those of yachts which have been engaged in the long series of contests which have been held for the possession of the "America" cup. When the club moved to its present quarters, the idea suggested itself of grouping the "America" cup contestants together, and placing them in chronological order, so that the yachts that competed in any particular period might be compared side by side. The result is seen in the accompanying photograph, which represents the north wall of the large model room; and it is safe to say that among the numerous histories that have been written of the "America" cup, brief and lengthy, good, poor, and indifferent, there is none that tells the story with such meaning and fidelity as does this picturesque, and, to the yachtsman, extremely fascinating group of models.

Referring to the engraving, model 1 represents the historic "America," a fore-and-aft schooner, 80 feet on the water-line, 94 feet over all, 22½ feet beam, and drawing 11½ feet. In a frame directly below the "America" model is the original drawing of the yacht's lines from which she was built, a truly classic sheet of paper. The group does not contain the model of any of her competitors. Number 2 is the model of the "Magic," which beat the "Cambria," model 3, the first English yacht to challenge for the cup, by 39 minutes and 12.7 seconds, corrected time. Another competitor among the fleet of fifteen yachts that sailed against the "Cambria" was the schooner "Madeline," model 4, which came in about fourteen minutes after the English boat. The "Cambria" was a keel schooner, 108 feet on the water-line, 21 feet in beam, and drawing 12 feet of water, and her defeat by the centerboard schooner "Magic," a much smaller craft, was an extremely creditable performance. These races took place in August, 1870, and the owner of the "Cambria," not to be discouraged by his defeat, challenged for a race to take place the next year, and brought over the "Livonia," model 5, a keel schooner, 115 feet 2 inches on the water-line, with 23 feet 7 inches beam, and 12 feet 6 inches draft. In the first race, which took place October 16, 1871, the centerboard schooner "Columbia," model 6, was selected as being the best suited to the light-weather conditions on that day. She won from "Livonia" by 25 minutes and 28 seconds. The second race was also won by the "Columbia" in 10 minutes and 33 seconds. For the third race, as there was a strong breeze blowing, the keel-schooner "Dauntless," celebrated for her heavy-weather work, was brought to the line. Just before starting she was disabled, and the "Columbia" took her place.

After a series of mishaps the latter came home 15 minutes and 10 seconds behind the "Livonia." In the fourth race, the challenger met the celebrated keel-schooner "Sappho," model 7, 120 feet on the water-line, which beat the "Livonia" by 30 minutes and 21 seconds, and again in the last race by 25 minutes and 27 seconds. The next two challengers came from Canada. The first was a centerboard schooner, the "Countess of Dufferin," which was beaten by the "Madeline" in the first race by 10 minutes and 59 seconds, in the second race by 27 minutes and 14 seconds. The other Canadian challenger was the 64-foot centerboard sloop "Atalanta," which succumbed to the 61-foot centerboard sloop "Mischief," model 8. She was badly beaten in the first race by 28 minutes 20¼ seconds; in the second race, 38 minutes and 54 seconds.

From this time on, all the races for the cup took place between single-masted vessels. The cutter "Genesta," model 9, 81 feet on the waterline, 15 feet beam, 13 feet 6 inches draft, met defeat in 1885 at the hands of the centerboard sloop "Puritan," model 10, which was 81 feet 1½ inches on the water-line, 22 feet 7 inches beam, and 8 feet 10 inches draft, losing the first race by 16 minutes 9 seconds, and the second race by 1 minute and 38 seconds. The following year the cutter "Galatea," model 11, 87 feet on the water-line, and of the same beam and draft as "Genesta," was defeated by the "Mayflower," model 12, 85 feet 6 inches on the water-line, 23 feet 6 inches beam, and 9 feet 9 inches draft, the first race being won by 12 minutes 2 seconds, and the second race by 29 minutes 9 seconds. Then came "Thistle," model 13, of 86 feet 6 inches water-line, 20 feet 3 inches beam, and 14 feet draft, which was beaten by

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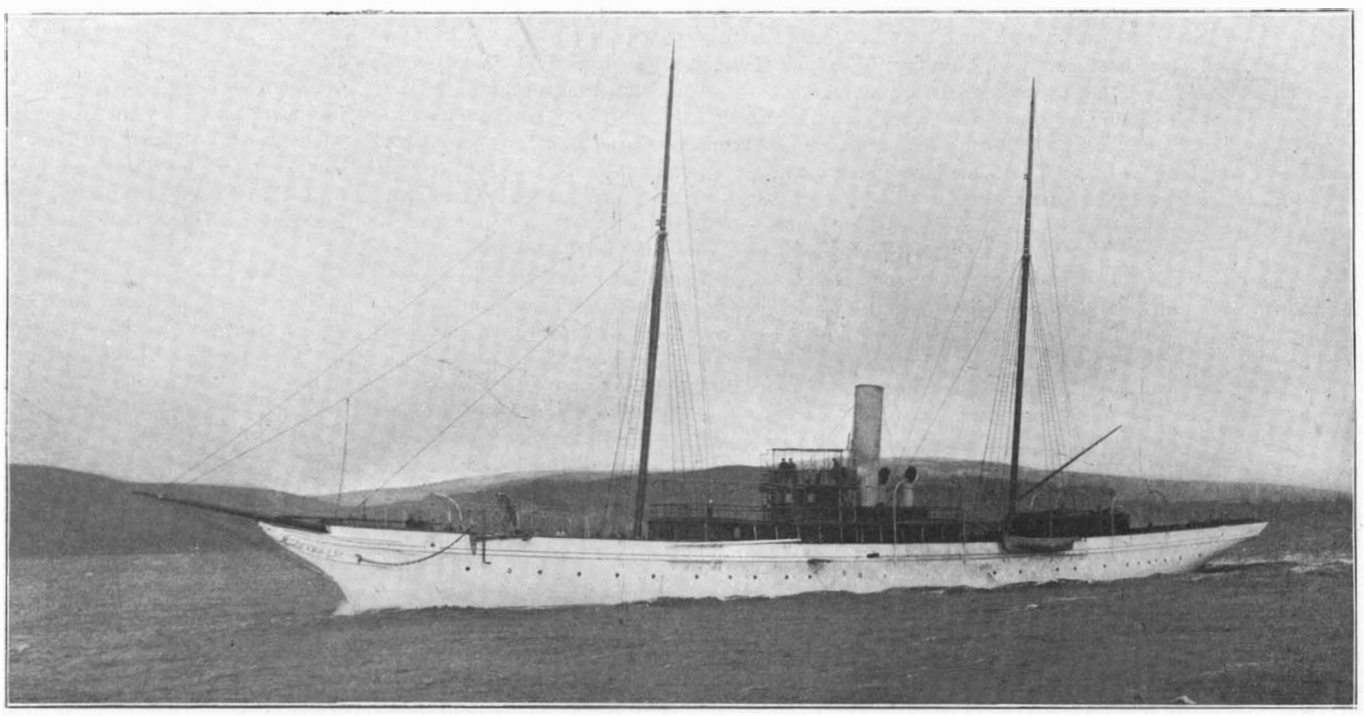
the "Volunteer," model 14, by 19 minutes 21¾ seconds, and in the second race by 11 minutes 48¾ seconds. After a lapse of six years, "Valkyrie II.," model 15, came over in 1893. With a water-line length of 85 feet, she had a beam of 22 feet 6 inches and a draft of 17 feet 6 inches. She met "Vigilant," model 16, 86 feet 2 inches on the water-line, 26 feet beam, and 13 feet 6 inches draft, and lost a series of three races, being beaten in the first race by 5 minutes 48 seconds, in the second race by 10 minutes and 35 seconds, and in the third race by 40 seconds. For the defense of the cup in that year no less than four 90-foot sloops were built, "Vigilant," "Jubilee," model 22, "Pilgrim," model 23, and the keel schooner, the "[illegible]onia," whose model does not appear in this group. The "Jubilee" was a fin-keel boat with a centerboard which dropped through the fin. Her rudder was carried on a skag, as shown in the model, and in this respect she anticipated some of the fastest of the yachts of the present day. "Pilgrim" was also a bulb-fin yacht, of small displacement, which depended for her stability on a light bulb carried at the extraordinary depth of 22 feet. The "Jubilee" was a moderate success, but the "Pilgrim" proved to be a complete failure. Two years later "Valkyrie III.," model 17, which measured 88 feet 10 3-16 inches on the water-line, 26 feet 2 inches in beam, with a draft of 20 feet, lost to the "Defender," model 18, 88 feet 5⅜ inches water-line, 23 feet 3 inches beam, and 19 feet 4 inches draft, losing the first race by 8 minutes 49 seconds, the second race on a foul, and the third by default. Then came an interval of four years, and in 1899 commenced the "Shamrock"-"Columbia" era.

"Shamrock I.," model 19, was 87 feet 8¼ inches on the water-line, 25 feet 5 inches beam, and nearly 21 feet in draft. She met "Columbia," model 20, 89 feet 7⅛ inches water-line, 24 feet 2 inches beam, and slightly less than 20 feet draft, losing the first race by 10 minutes and 8 seconds, the second by being disabled, and the third by 6 minutes and 34 seconds. In 1901 "Shamrock II.," model 21, 89 feet 3 inches on the water-line, 24 feet 5 inches beam, and draft of between 20 and 21 feet, met the "Columbia," which had proved a faster boat than "Constitution," model 24, which had been built especially for the defense of the cup that year. "Constitution" was practically the same in all dimensions and in outboard profile as "Columbia," the chief point of difference being that she carries 1 foot more beam. The "Shamrock II."-"Columbia" series were particularly close. The "Columbia" won the series by 1 minute 20 seconds, 3 minutes 35 seconds, and 41 seconds.



STEAM YACHT "NORTH STAR," FORMERLY "CHEROKEE," NOW OWNED BY CORNELIUS VANDERBILT, ESQ

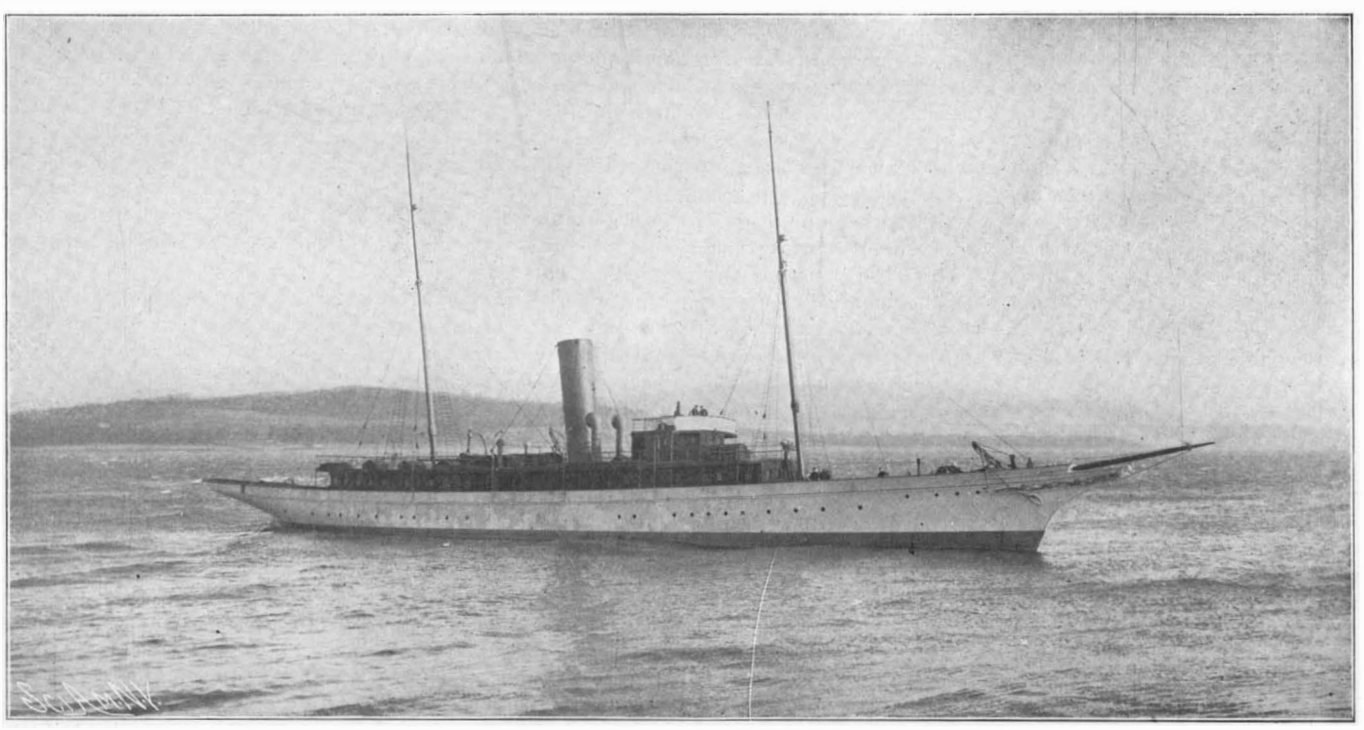
Length over all, 243 feet. Length on waterline, 219.5 feet. Beam, 29.15 feet. Draught, 16.3 feet.

THE "EMERALD" TURBINE YACHT.

Special interest is taken in the steam yacht "Emerald," which was purchased early this year by Mr. George Gould, from the fact that she represents the most important attempt yet made to adapt the principle of turbine driving to the wants of yacht owners. The hull of the "Emerald" was built on the Clyde by Messrs. Stephen & Sons, and the engines were supplied by the Parsons Marine Steam Turbine Company, of Wallsend-on-Tyne. Apart altogether from her novel system of driving, the "Emerald" would be worthy of attention as one of the smartest and most handsome yachts ever built on the Clyde. Her length over all is 236 feet, and she has 28 feet 8 inches beam and 18 feet 6 inches of molded depth, giving a yacht measurement of over 750 tons. She was built under special survey to rank 100 A1 at Lloyds. The hull is beautifully modeled, with fairly long and very shapely overhangs both fore and aft. The bow is of the clipper type and is finished with a figurehead of elaborate carving. She is schooner rigged, with two masts and one funnel, and presents altogether an exceptionally well-balanced model. A fine promenade deck is carried from side to side of the boat, and on this is a large deck house divided into navigating room and deck lounge.

The saving of space effected below deck by the adoption of the turbine system of driving has enabled the designer to lay down state and other rooms of exceptional size. There is a suite of four staterooms with bathrooms, and attendants' rooms, six extra staterooms for guests, and several rooms for valets and personal servants. The dining-room, drawing-room, and smoking-room are planned in a free treatment of the English and French Renaissance, and are luxuriously fitted. A photographic room situated aft, and fitted with all the appliances necessary for a free indulgence of this hobby, is one of the special features.

It is, however, in the turbine system of driving that the main interest of the boat is centered. There are three sets of steam turbines, one high-pressure and two low. Each turbine drives one length of shafting. The center shaft carries one propeller, and each of the two outside shafts has two. As the turbines have been found to do their most satisfactory work when running at a very high speed, the propellers are of small diameter, the center one being 36 inches, and the four side propellers being only 20 inches. All these fittings are of manganese bronze. There are therefore only five propellers on the "Emerald" as compared with nine on the smaller yacht "Tarantula," which was the first yacht to be fitted with turbine engines. The hull has been specially designed to obviate any danger of vibration from the great speed at which the propeller shafts are run. The contract speed of the yacht is only 16 knots, but her speed in service is expected to be considerably greater than this.



THE NEW TURBINE YACHT "EMERALD," OWNED BY GEORGE J. GOULD, ESQ.

Length over all, 236 feet. Beam, 28.6 feet. Molded depth, 18.5 feet. Driven by turbine engines and five propellers on three shafts.

THE STEAM YACHT "NORTH STAR."

The handsome steam yacht "North Star" is one of several notable steam yachts recently added to the pleasure fleet of America. She was designed by Mr. W. N. Storey, an English designer of repute, and built for an English nobleman, Lord Ashburton by name. After her purchase in America by Mr. Cornelius Vanderbilt, she was sent back to the Clyde to be remodeled internally. On the return passage to the Clyde in the middle of October, she gave a sample of her powers of fast and steady steaming, making the run from Sandy Hook in 10 days 23 hours. This run and a previous trip to America in 10 days 14 hours mark the record for the double transatlantic passage for a boat of her size. On her arrival in the Clyde she was handed over to Mr. George L. Watson for remodeling, and on this work a sum of $60,000 was spent. The heavier part of the work was done on the Clyde, and the yacht was then sent to Havre, where a French firm is still engaged with the upholstery and decorations.

We are indebted to Messrs. Tams, Lemoine & Crane, through whom the recent purchase was effected, for the following particulars of the dimensions, and the interior modifications, which were carried out under their supervision:

Length over all, about 243 feet; length on the water line, 219.5 feet; length between perpendiculars, 233.5 feet; beam, 29.15 feet; depth of hold, 18.9 feet; draught, extreme, 16.3 feet; horse power, nominal, 223. Triple expansion engines, 21½, 34, 56 inches diameter by 34 inches stroke. Two boilers, Scotch type, built for a working pressure of 160 pounds. Bunker capacity, 215 tons.

She has a shade deck which, as shown in the photograph, extends aft to the engine room skylight. On this deck is a commodious room, the forward part of which is used as a chart room; the rest is what might be called an observation room for the owner and his friends. On the top of this house a navigating bridge has been added, with wings extending out to the rail line. On the main deck in the forward end of the house is the forward sitting room; just aft of it is a vestibule leading down into the quarters below, which consist of, just forward of the machinery bulkhead, a large pantry with lift and stairway to the galley above. Forward of the pantry is a large dining-room extending the full width of the ship. On the starboard side forward is Mrs. Vanderbilt's suite, consisting of a roomy stateroom, forward of which and communicating, is a large bath and dressing room. On the port side is the owner's suite, consisting of two rooms and bathroom; forward of which are four guests' rooms, dress closet, maid's room,

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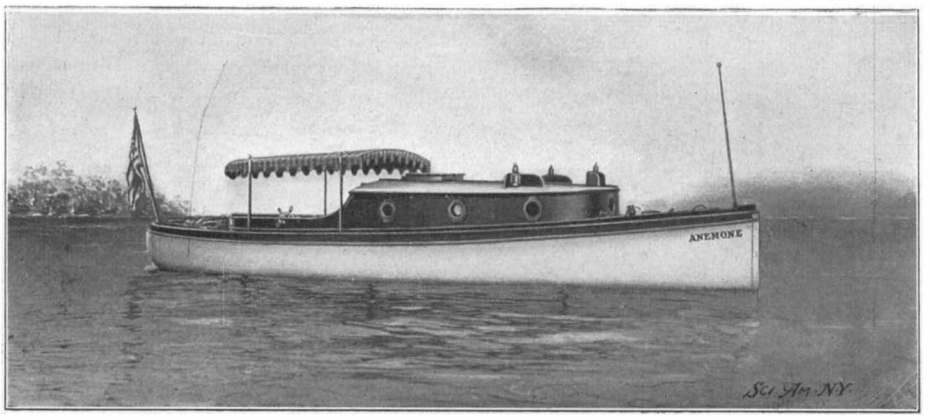
linen lockers, bathroom, etc. In the after house on the main deck is the smoking room and the owner's sitting room and office; aft of which is the vestibule leading to the owner's quarters below, which consist of a drawing-room going the full width of the ship. Aft of this are two other staterooms, with bath adjoining and communicating. The officers' quarters are aft of this; the crew's quarters at the forward end.

A GASOLINE LAUNCH FOR CRUISING.

One of the signs of the times in the yachting world is the extended use that is being made of the gasoline launch for cruising—not for a mere half-day trip, or brief run between two adjacent harbors, but for genuine cruising that may last into the weeks or months. Hitherto the small cruiser has usually depended upon sail power alone, being either sloop, yawl or knockabout; but to-day there is a growing demand for gasoline launches that are fitted with all the sleeping, cooking and lavatory accommodations necessary for cruising. We illustrate a launch of this type that is built by the Lozier Motor Company, of Plattsburg, N. Y.

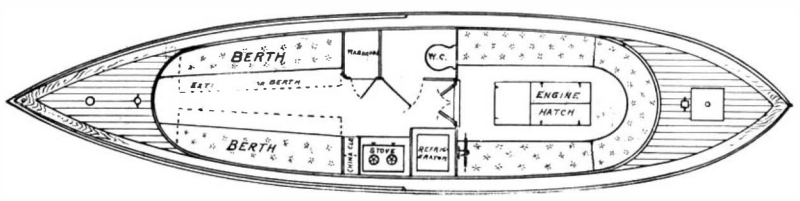
The danger from gasoline explosions—be it real or imaginary—has deterred many from using a gasoline launch with a tight cabin where an accumulation of gas may render an explosion quite possible; but in this boat the danger has been guarded against by placing the gasoline tank in the bow and separating it from the rest of the boat by a watertight bulkhead. The gasoline is conducted from the tank to the engine by a seamless brass pipe running outside of the hull, so that there is no possibility whatever of gasoline or gas finding its way into the cabin. This watertight bulkhead also acts as a collision bulkhead, and renders the boat non-sinkable.

The length of the boat over all is 31 feet 7 inches; beam, 7 feet 2 inches; and her extreme draught 28½ inches. The forward deck is 5 feet 3½ inches in length. Aft of this comes the main cabin, 7 feet in length, fitted with a transom on each side with extension lids, allowing their being used as berths. Aft of the cabin is a passageway 4½ feet in length. On the starboard side of this, immediately aft of the cabin, is a wardrobe locker extending from floor to ceiling and entered by a door opening from the passageway. Aft of this is the toilet room, finished in quartered oak panels and entered from the passageway by a door. On the port side of the passage is situated a china closet; aft of this is a brass-lined compartment for the oil stove, and aft of this is an asbestos and zinc-lined refrigerator. Underneath the stove compartment is a provision box. A double door from the passageway leads into the cockpit, which is 8 feet long. The cockpit is furnished with seats all around. The seats at the side of the engine are fitted with extension lids, so that they may be used for berths if it is desired to sleep more people than can be accommodated in the main cabin. The floor of the cockpit is 7 inches above the water-line, and is self-draining.



A CRUISING GASOLINE LAUNCH.

Length, 31 feet 7 inches. Beam, 7 feet 2 inches. Extreme draught, 2 feet 4⅛ inches.

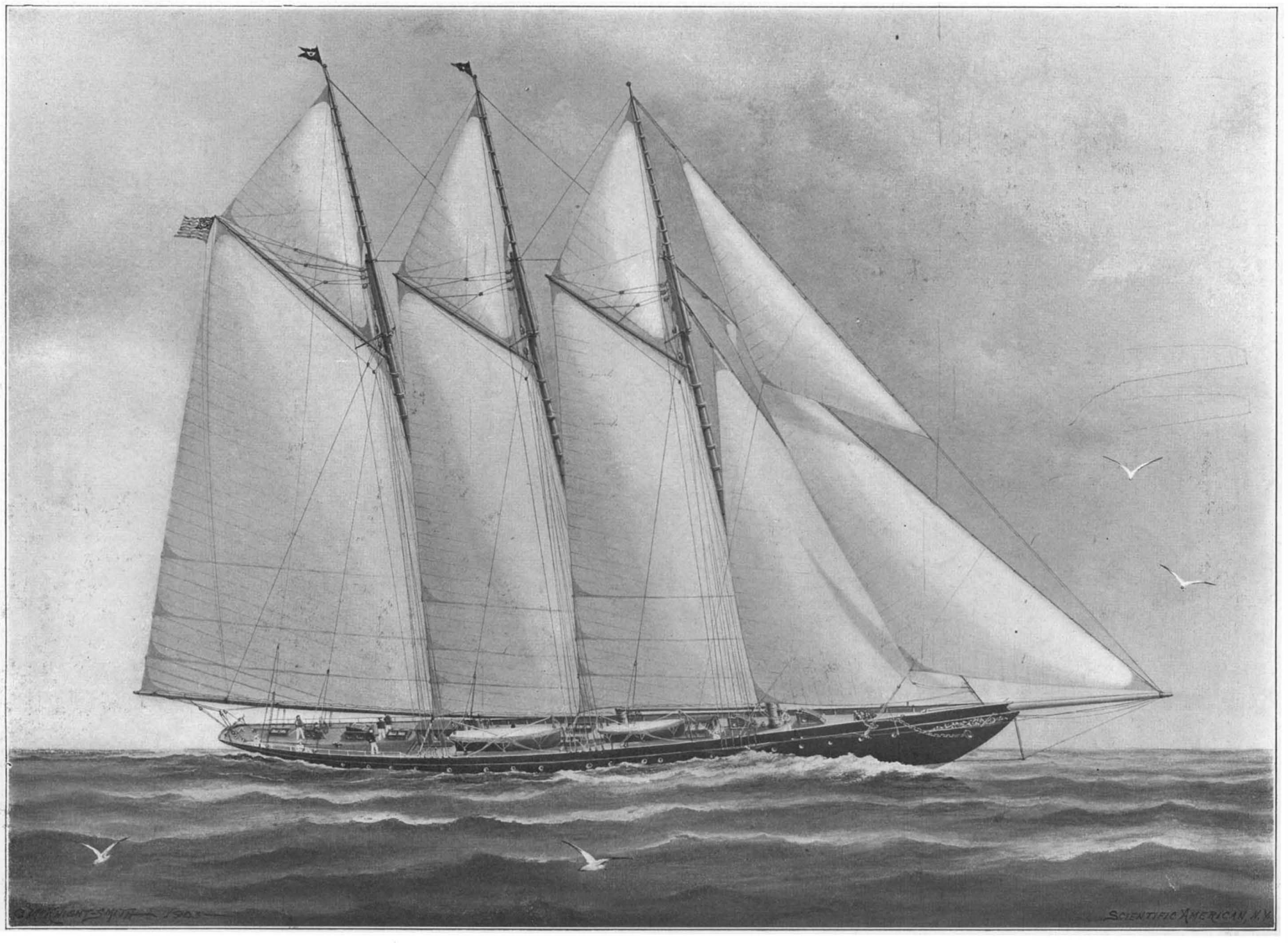


DECK PLAN, SHOWING ACCOMMODATIONS.

The motive power is furnished by a 7½ horse power Lozier single cylinder, two-cycle engine, equipped with magneto, batteries and reversing mechanism. The engine is inclosed in a portable oak case with folding hatches; the top of this case being on a level with the cockpit seats allows the same to be utilized as a dining table in fair weather. The generous amount of space given to wardrobe, china closet, the refrigerator, and the stowage space afforded by the lockers underneath the seats in the cockpit, together with the fact that the gasoline tank has a capacity of 54 gallons, allows this craft being taken on an extended cruise.

NEW THREE-MASTED AUXILIARY SCHOONER.

One of the largest fore-and-aft sailing yachts ever constructed, and certainly the fastest auxiliary of this rig, is the extremely handsome three-masted schooner of which we show an illustration on this page. The new schooner, which is from designs by William Gardner, of the firm of Gardner & Cox, is a noble craft of a water-line length of 135 feet and 184 feet in length over all. Her extreme beam is 29 feet and she has the moderate draught of 15 feet. For windward work she carries a rectangular centerboard, 20 feet in length, which when down will give an extreme draught of about 20 feet. The board is arranged to house below the floor of the vessel, consequently there will be no interference of the centerboard trunk with the interior cabin accommodations. The vessel shows the beauty of modeling which characterizes this designer's work. While her midship section is powerful, it is free from any of the extreme features which are seen in many modern vessels intended, as this one is, for high speed. The bilges are easy, the garboards well filled out. The water-line shows a fine entrance and run and, by virtue of the great length of the yacht, the designer has obtained what are probably the easiest and longest diagonals ever



NEW THREE MASTED AUXILIARY SCHOONER NOW BEING BUILT FOR WILSON MARSHALL, ESQ.

Length on waterline, 135 feet. Length over all, 184 feet. Beam, 29 feet. Draught, 15 feet. Motive Power: One triple-expansion 350-horsepower engine, two Almy boilers.

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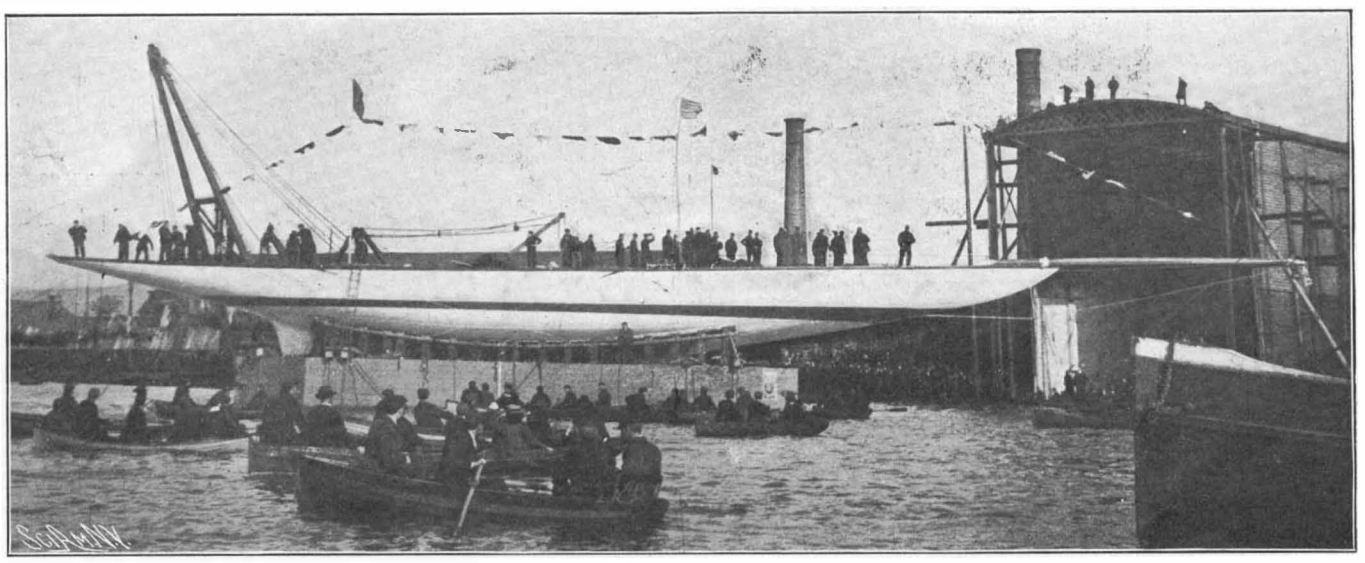
seen upon a large schooner of this type. The model is one of the sweetest and fairest we have seen for a long time and there is no question that, with started sheets, the craft should be able to reel off the knots at a speed equal to that of the famous "Sappho" of former years.

As the schooner is intended mainly for cruising, it was considered desirable to carry her big sail plan upon three sticks, and while this will render her not quite so fast a boat in windward work, it will, of course, conduce greatly to ease of handling, especially in heavy weather. The foremast is 72 feet to the hounds, the mainmast 76 feet, and the mizzen 79 feet, while the respective topmasts measure 48 feet, 52 feet and 54 feet. The gaffs of the foremast and mainmast are both 33 feet in length, while the mizzen gaff is 49 feet. The booms measure respectively 34, 33 and 78 feet in length. The bowsprit has a length outboard of 27 feet and the spinnaker pole is about 70 feet in length. The yacht carries a 350 horse power triple-expansion engine and two Almy water-tube boilers, the engine and boiler rooms being located between the fore and main masts. On the starboard side of the engine room are seven staterooms for the captain and officers, while the rest of the space forward of the mainmast is occupied by the pantry, galley, and accommodations for the crew, which latter include fourteen bunks. Just abaft of the mainmast is a bulkhead, abaft of which, on the port side, is the breakfast room and on the starboard side a stateroom. Abaft of these is the main saloon, which extends entirely across the yacht with a width of 28 feet. Then comes the second bulkhead, abaft of which, on the starboard side, are two staterooms and on the port side a stateroom and two separate bathrooms, while amidships in this compartment is located a lobby reached by the main companionway, which leads down from a deckhouse just abaft of the mizzenmast. Abaft of the companionway is the owner's stateroom, which, like the main saloon, extends entirely across the vessel.

Our drawing, which represents the yacht close-hauled on the port tack, serves to show the lofty bow and handsome sheer of the vessel, and the general beauty of the deck lines. Altogether, the new craft, which is being built for Mr. Wilson Marshall, the former owner of the schooner yacht "Atlantic," will be one of the most imposing and handsome sailing craft of the year

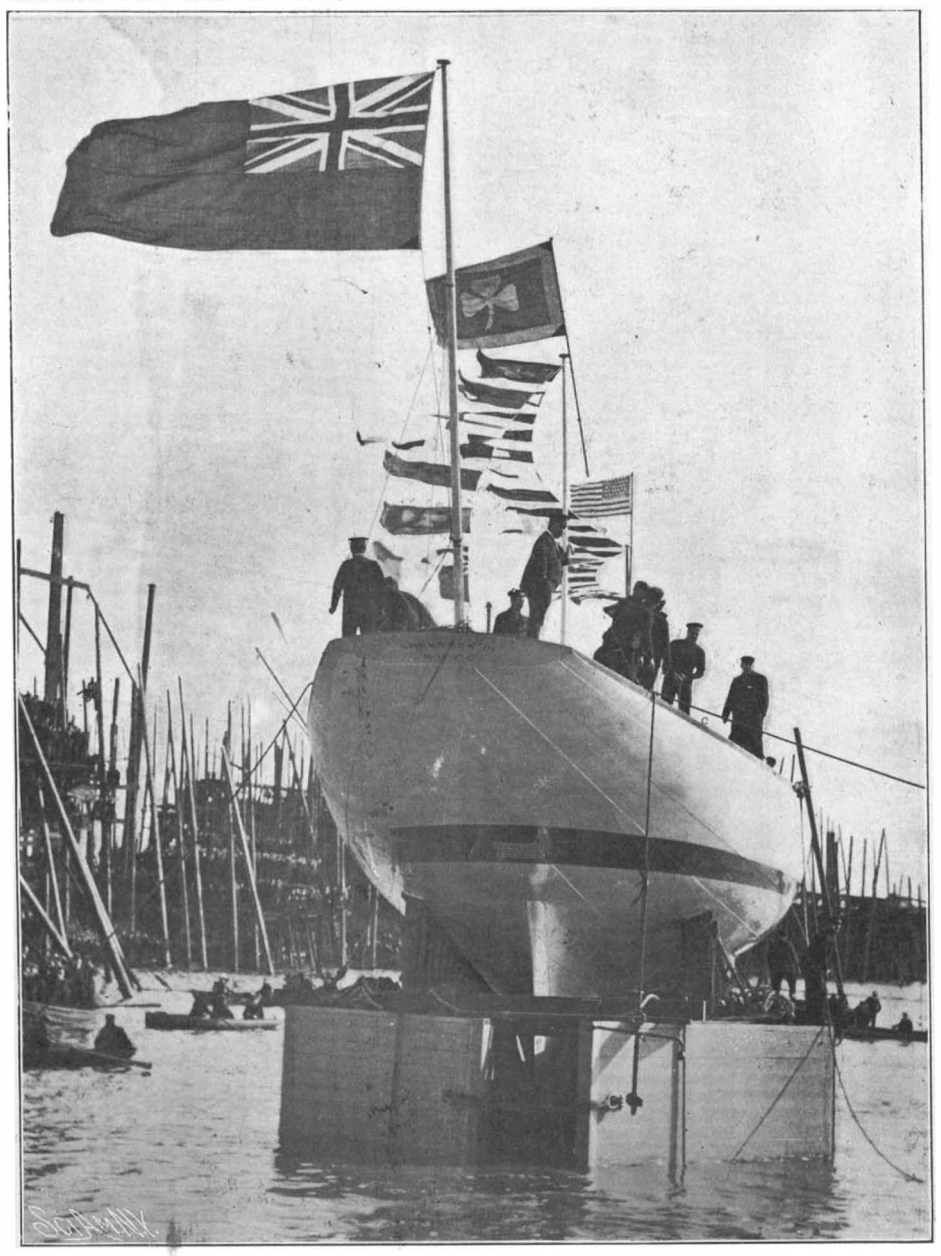


THE "SHAMROCK III." ON THE PONTOONS ON WHICH SHE WAS LAUNCHED.

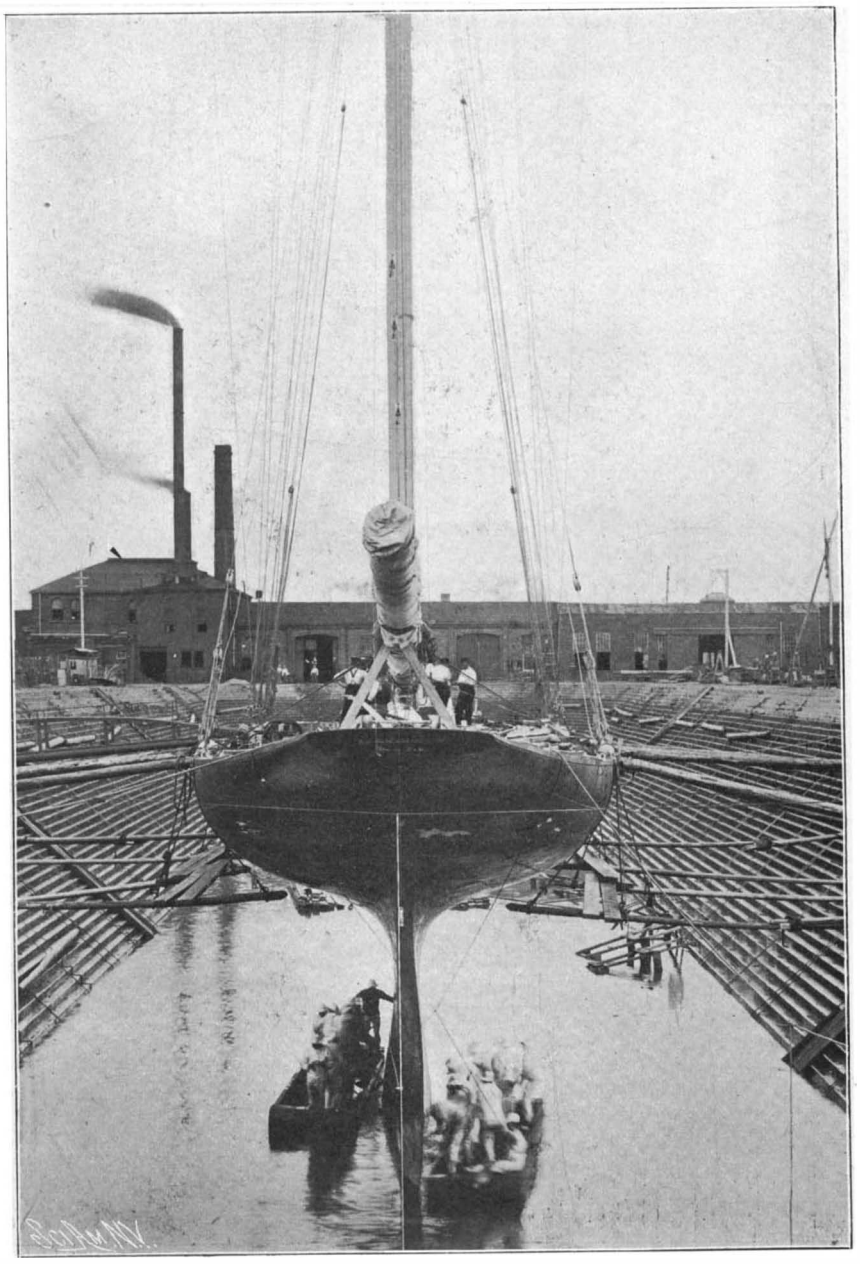
THE LAUNCH AND EARLY TRIALS OF "SHAMROCK III."

BY OUR GLASGOW CORRESPONDENT.

In measurements alone the third Lipton challenger would stand out as distinct from any of the recent yachts which have crossed the Atlantic to do battle for the "America's" Cup. Hitherto the challengers, with the possible exception of "Valkyrie III.," designed by Mr. George L. Watson, have followed a distinct line of development. The progress from one to the other was easily traced, and the efforts made in each succeeding boat to make good the apparent weaknesses of her predecessors were easily distinguishable. In the bold bid which "Shamrock II." made for success in her contest with "Columbia," Mr. William Fife had in his designing of "Shamrock III." strong temptation to follow the same lines, but an inspection of the new boat, opportunity for which was kindly given by Sir Thomas Lipton to our representative before the hour fixed for the launch, showed that he had chosen to return in some very essential features to the type of model of the "Britannia"—whose successful defeat of "Vigilant" led to the embodiment by Herreshoff of "Britannia's" lines, greatly refined, in "Defender." The result is that "Shamrock III.," while having the outstanding features which have characterized all the recent Cup racers, possesses important developments which may, and probably will, make her the most formidable of the series of challengers. In waterline length there is little to distinguish "Shamrock III." from the other vessels built specially for Cup racing. It has long been a conviction with designers that the time allowance given for lack of waterline length does not put the shorter boat on a level with the yacht of greater length, and their desire has therefore been to build as near the allowable limit of 90 feet as possible. "Shamrock III." comes within a few inches of this limit, how many inches will not be known even to those in charge until the official measurement is made, but in the matter of over-all length—which goes untaxed—the new challenger is more extreme than any cup yacht which has been built. Forward she has an overhang of 25 feet, and a similar length in the counter brings the total length from stemhead to taffrail to 140 feet. The beam also presents another peculiarity which is well worthy of



STERN VIEW OF "SHAMROCK III." SHOWING HER BROAD AND POWERFUL QUARTERS.



"SHAMROCK II." IN DRYDOCK AT THE ERIE BASIN, SHOWING HER SHALLOW AFTERBODY AND NARROW STERN.

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attention. The beam of the new yacht is less than that of either of her predecessors, for at her point of greatest breadth she measures only 22 feet 6 inches, as against 24 feet 5 inches in "Shamrock II.," and 25 feet 5 inches in "Shamrock I." In both the former Cup challengers, however, from the point of greatest beam the deck line ran off fore and aft in a rather flat curve. In "Shamrock III.," however, the beam has been carried well out fore and aft in such a manner as to give her, on the smaller measurement, a greater effective beam, and far sweeter sailing lines on the whole length of the boat. One of the most characteristic features of "Shamrock II." was the extreme fineness of the quarters; the after sections being reduced so greatly that she measured only six feet across the taffrail. The forward sections, on the other hand, were relatively full, with the result that the center of displacement lay unusually far forward. In the new boat, on the contrary, there is no such fining down of the quarters, and there is an indication of power in the boat right up to the taffrail. Watson lost four of five feet of effective sailing length on "Shamrock II." when she was heeled; but the new boat when reaching will probably carry her stern wave clear to the covering board, and gain all the increased length of waterline, and smoothness of wake that go with such a stern as she shows. By comparing the stern view of "Shamrock II.," side by side with a similar view of her successor, the greater power of the new boat will be readily seen. When it is also borne in mind that "Shamrock III." has about two feet less beam, one can understand that her diagonal lines must be easier, and that she should prove a much faster boat in reaching. That she is so appears to have been proved by the recent tests against "Shamrock I."

The stern view also serves to give a good idea of the midship section of the new boat, and it bears out the truth of our previous statement that Fife had made a considerable return to the easy low bilge, great deadrise and full garboards of the moderate cutter type. At the same time she departs from the cutter type in the comparative fullness of her waterlines, especially aft (see the parallel flotation strips on the dark strip above the rudder post). It is something of a puzzle, indeed to understand how such full ends and long overhangs could be combined with such a deep midsection, and the fair sweep of the lines be maintained; but that it has been successfully accomplished is proved by the photographs, no matter from what point of view the boat is seen.

Looked at from the broadside, "Shamrock III." is unquestionably a beautiful craft, with graceful overhangs, and just the right amount of sheer. Her draft of 19 feet is less by from a foot to a foot and a half than that of her two namesakes. Her weight of hull, spars, etc., works out as the same as "Shamrock I.," but she carries more lead, and has a larger displacement. She has less wetted surface, larger sail area, a much sweeter form—a combination that should render her faster on every point of sailing under any possible conditions of wind or sea.

That these expectations were justified has been proved in the first sail-stretching trials. On the first day in light breezes she beat "Shamrock I." on every point of sailing, lying closer to the wind and footing faster with sheets well aboard, and fairly running away from her on a reach—the strongest point of sailing in the earlier vessel. On the second trial she allayed all anxiety as to her behavior in a blow, carrying a clubtopsail easily in the puffs, and again "sailing all round" the boat of 1899. Already, before she is tuned up, she appears to be several minutes faster, except perhaps in running under spinnaker, than "Shamrock II." or "Columbia," so that apparently it is now "up to" Mr. Herreshoff to make a big advance on any of his previous boats.

The contest this year will be truly international—an improved "Vigilant," with that boat's beam and a flatter floor, but without her center board, being pitted against an improved "Britannia." The coming races should be the most exciting that have yet been sailed for the Cup.

The Current Supplement.

The current SUPPLEMENT, No. 1423, begins with an article on "Motors in Agriculture." The article is to be concluded in the next issue; the second installment will be illustrated with the motor plow, referred to in the article on "Automobiles in Warfare," published in this issue of the SCIENTIFIC AMERICAN. Prof. Franz Boas, well known as a student of ethnology, discourses on the mind of primitive man. Of technological interest is an article on the preservation of unfermented grape juice, very fully illustrated. That the idea of producing machines able to talk is by no means new with us, is shown by an entertaining account of the old speaking apparatus invented by Wolfgang von Kempelen. The new observation-kites invented by S. F. Cody are described. Gilbert T. Walker explains the theory and construction of the boomerang. "Recent English Archæological Work" is the title of an article that will, no doubt, be of interest to our archæological readers. Charles F. Holder tells something of the big things of the West. Dr. Alexander Johnson gives his personal experience in radiography, together with the technique of stereoscopic radiography.

Automobile Department

THE FOREIGN AUTOMOBILES OF PROMINENT AMERICANS.

Our illustrations show three machines owned by well-known Americans, the fourth being one of the latest small Renault racers recently brought to this country by M. Klutz.

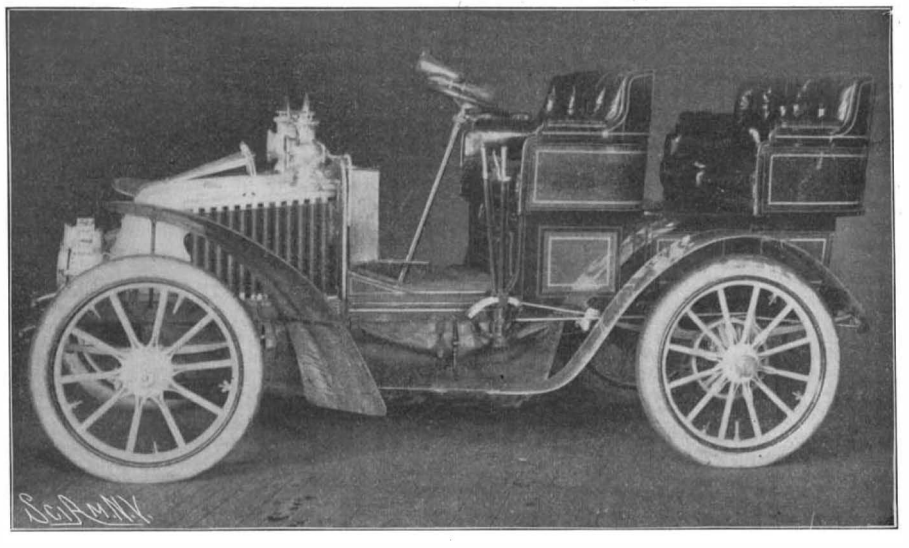
The huge machine just above it is the 45 horse power Mercedes touring car belonging to Mr. Harry Payne Whitney. It is a very commodious machine, capable of accommodating seven persons, and of traveling at as high a speed as 50 miles an hour. The machine is the product of the Daimler Company, of Cannstatt, Germany, and is fitted with beehive radiator, mechanical inlet valves and igniters, and all the appliances which have made that firm famous.

The natty car facing it is a 16 horse power, double-cylinder Renault, the property of Mr. J. Insley Blair. The 16 horse power, two-cylinder motor drives the rear axle direct through a change gear box giving four speeds forward and one reverse. A bevel gear drive and live rear axle are used. One of the peculiar features of the Renault cars is the placing of the water-cooling coils on each side of the motor bonnet instead of in front. Another distinguishing point is the chassis of steel tubing. The Renault Frères are among the few constructors who still use this kind of frame. The machine in question weighs about 1,200 pounds, and is capable of speeds of between 30 and 40 miles an hour. A Renault racer built on similar lines to the machines here shown was the winner of the Paris-Vienna race last year.

The small racer has a 12 horse power, single-cylinder de Dion motor, with an air-cooled cylinder and water-cooled head. A three-speed gear is used, which makes the machine capable of attaining speeds of nearly 50 miles an hour. It is a very light car, its weight complete being considerably under 1,000 pounds.

The last car of the group is the beautiful blue Panhard, the graceful curves of whose "King of the Belgians" body were admired by visitors at the Automobile Show last January. The car is now the property of Mr. R. G. McCurdy. The body is of aluminium, and was built in this country. As it is now possible to get such bodies in this country, the importers of French machines frequently bring over only the chassis, and have a body built to fit it here. The Panhard shown has a 15 horse power, two-cylinder motor, together with a four-speed gear, and is capable of speeding up to about 40 miles an hour.

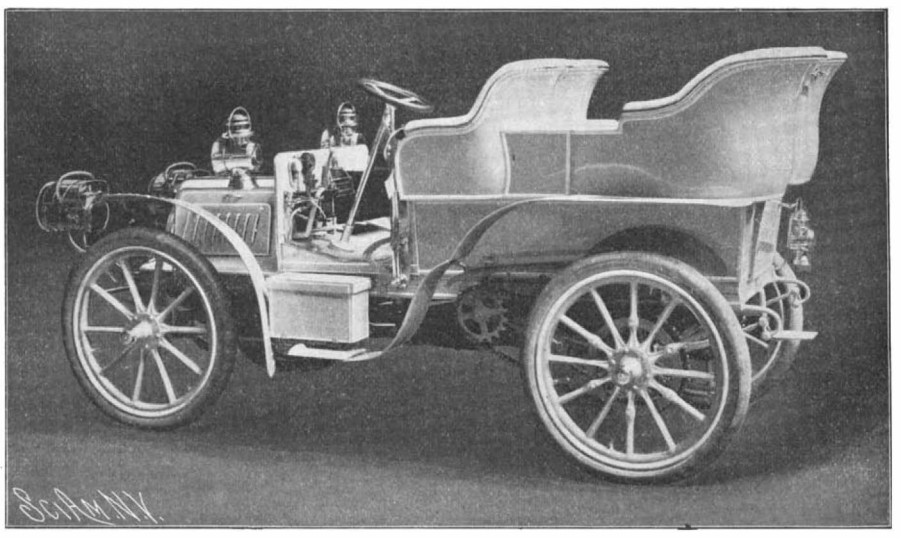
15 H. P. MERCEDES TOURING CAR.



16 H. P. RENAULT LIGHT CAR WITH DETACHABLE TONNEAU

Photographs made especially for the SCIENTIFIC AMERICAN.

12 H. P. RENAULT RACER, PARIS-VIENNA TYPE.



15 H. P. PANHARD WITH ALUMINIUM BODY.

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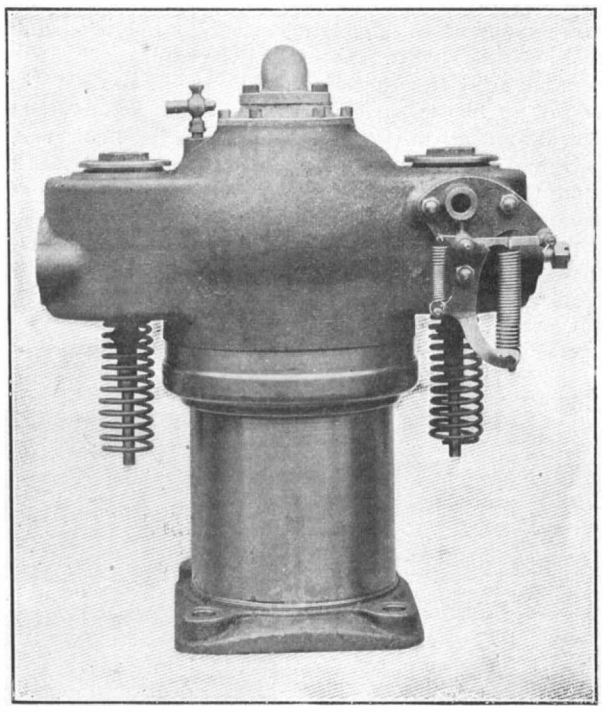
SOME 1903 MODELS.

The Winton 20 horse power touring car for 1903 resembles that of last year in its main features. A slightly larger, double, opposed-cylinder motor is employed, which drives, through a spur gear transmission and chain, the rear axle. One of the noteworthy features of this motor, as can be seen in the illustration, is the copper water jacket extending from the crank case to the cylinder head, and making a box, square in cross section, of the cylinder. Copper water jackets are used on several other American cars this season, and they offer advantages that Mr. Winton has seen and made use of for years. The 1903 touring car has two speeds ahead and reverse. All ordinary running is done on the high gear by throttling the motor. When on this gear, the drive is direct by chain from the motor shaft to the rear axle. The throttle is operated by compressed air from a small plunger pump with piston rod connected to the crank shaft. The air pressure acts on small pistons fastened to the inlet valve stems, thus working against the suction of the motor pistons and keeping it from opening the valves but slightly, save when the air is by-passed by pressing on a pedal. The result is an extremely flexible throttle control. The charge-igniting spark jumps in both cylinders every time, the plugs being connected in series. This makes for simplicity, as a single spark coil and contact device only are needed. Of the two levers, the shorter one operates the slow speed and reverse, while the longer one throws in the high-speed clutch, or, when pushed forward, applies the band brake on the transmission shaft. A foot brake operates band brakes on the hubs of the rear wheels, which are shod with 32 x 3-inch detachable tires.

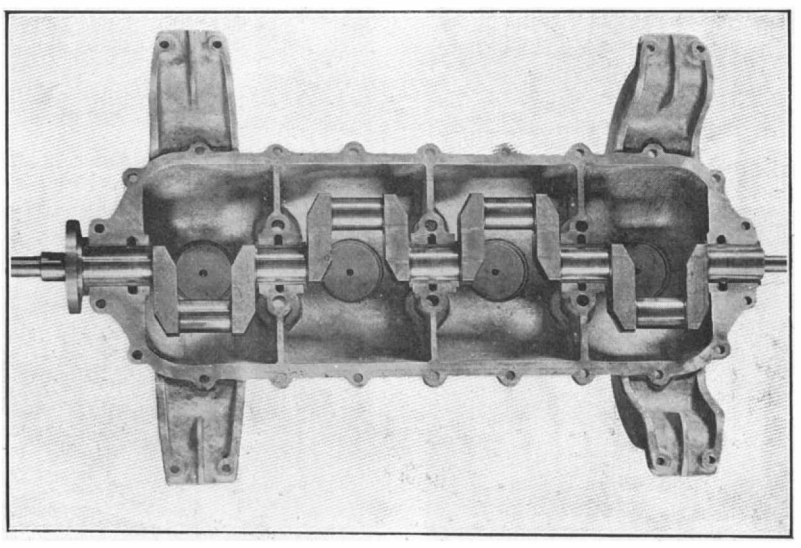
The Grout steam tonneau is an example of the style in steam cars for 1903. Of about half a dozen steam tonneaus seen at the New York Automobile Show, the Grout was the most conspicuous and locomotive-like in appearance, because of its cowcatcher. This serves the double purpose of clearing the road and protecting the condenser from damage in the event of a collision. The boiler is located under the bonnet. It is of 12 horse power, and is provided with a scoop below and above. The upper one, projecting above the bonnet, catches a current of air, and the draft set up over the boiler and through its flues carries all the fumes through piping to the rear. The 10 horse power engine is placed horizontally under the foot-board, and is connected by chain to the countershaft, which furnishes an independent chain drive to each rear wheel. Another feature of this car is the patented wheel throttle, consisting of a second wheel below the steering wheel and arranged to turn with it. The throttle wheel lifts up, working on a ratchet, and can be set at any desired speed, from which it can be released instantly by the foot. All parts of the Grout car are hung on an angle steel frame. The tanks furnished are sufficient for a 100-mile run. All the working parts are fitted with sight-feed oilers. The boiler has a fusible plug and low water alarm, and the car has steam, water and air pumps. It has a wheel-base of 7 feet, 32-inch wood wheels with 4-inch detachable tires, and the tonneau is removable if desired.

The "Arrow" tonneau is the latest production of the George N. Pierce Company. It has the rakish lines of a racer, and is a speedy little machine weighing 1,650 pounds and propelled by one of the new, 15 horse power, two-cylinder de Dion motors. Sliding gears operated by a single lever give three speeds forward and one reverse. The transmission gear shafts run on ball bearings. The gear box is connected directly to the rear axle (where a bevel gear drive is employed) through a shaft with universal couplings, and on its front end is connected to the conical flywheel clutch of the motor. The machinery is all mounted on an underframe of steel tubing, which distinguishes the Pierce machine from other American makes. Hub brakes on the rear wheels and a double-acting brake on the transmission shaft add to the safety of the car. It is equipped with 32-inch wheels, shod with 3½-inch tires, and mounted on four long, semi-elliptic springs, all of which, combined with a wheel base of 6 feet, 9 inches, give it very easy riding qualities.

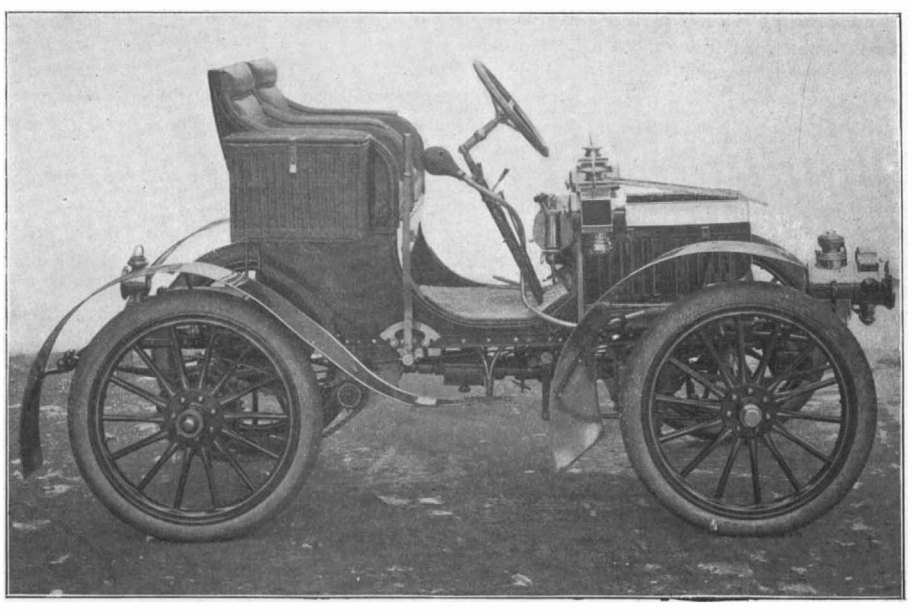
The Oldsmobile was the first successful American runabout to be built and marketed at a reasonable figure. Since its introduction two years ago, many improvements have been made on it, although the motor, transmission, and arrangement of machinery remain practically the same. Mr. Olds was the first to mount the machinery frame on two long side springs connecting the front and rear axles, thus doing away with the running gear with reaches, and making an exceedingly flexible gear. His knowledge of gas engines enabled him to design an automobile engine that would operate successfully. A good idea of this engine can be had from our view of the same with cylinder cut away, showing piston, mechanically operated exhaust and inlet valves, with the carbureter on the inlet pipe of the latter, and the spark plug. By changing the shape of the valve-raising cams, and employing the new carbureter, the power of the 4½ x 6-inch motor has been perceptibly increased. The transmission gear is of the planetary type and gives two speeds forward and reverse, with a direct chain drive from the motor shaft to the rear axle on the high gear. Both front and rear axles are now trussed to strengthen them, and the machine is equipped with wood wheels in place of wire ones. A hand-operated brake on the differential can be used in case of emergency. The motor develops about 4½ horse power at 700 R. P. M. The same sized engine is used in the physician's inside-operated brougham, a new model brought out this year; but it is geared for speed of but 15 miles an hour, instead of 20, as is the runabout. A third model is a tonneau car with a two-cylinder engine of the same bore and stroke.



CYLINDER OF PEERLESS MOTOR, SHOWING MECHANICALLY-OPERATED VALVES AND IGNITER.



CRANK SHAFT AND CRANK CASE OF PEERLESS FOUR-CYLINDER MOTOR.



THE JONES-CORBIN 8 H. P. LIGHT-WEIGHT GASOLINE CAR.

The new Peerless tonneau is one of the finest-appearing models brought out this year. The square, box-shaped bonnet and very long wheel base give the appearance of a speedy car that the motor is capable of fulfilling. The motor cylinders have a 4½-inch bore by a 5½-inch stroke, and its normal speed is about 900 R. P. M. The cylinders are cast in pairs and assembled to make two-cylinder, 12 horse power motors or four-cylinder, 24 horse power motors, as desired. The smaller car weighs 1,950 pounds and the larger about 2,300. The engine has a ball governor acting on a throttle valve, which can be thrown out of action at will. The inlet and exhaust valves are easily removable. On the latest Peerless racer, the inlet valves are mechanically operated, and arranged on the opposite side of the cylinder from the exhaust valves, as seen in the illustrations on this page. The other cut of the crank shaft is typical of all four-cylinder automobile motors. With the cranks set as shown, first one outside cylinder fires, then the next one to it, third the other outside cylinder, and fourth the one adjoining it. This furnishes an impulse every half revolution of the crank shaft, and makes a very steady and smooth-running motor.

The Jones-Corbin car, also shown on this page, is a light-weight, speedy little machine for two people. Its motive power is an 8 horse power de Dion motor, driving, through a sliding three-speed change gear, a countershaft, whence the drive is by chains to the rear wheels. The car is fitted with roller and ball bearings throughout. A beehive radiator is used for cooling the water, which is circulated by a powerful friction-driven pump. The steering wheel has a locking arrangement for keeping it where it is set. A speed of 35 miles an hour is guaranteed for this machine, the weight of which is but 700 pounds. A tonneau car of the same type, fitted with a 9 horse power motor, is also under construction.

Reduction of Noise in Automobiles.

The Motor World in a recent issue contains some timely remarks on the reduction of noise in automobiles. It says:

"As long as users were content to put up with the noise of gasoline cars, no very determined effort was made to silence them. There are both difficulties and drawbacks in the way, and with the many other problems to be solved it was felt that the matter of undue noise could well wait a little while. But the time for action has arrived, and real efforts to reduce the noise to a minimum are being made, and with no small degree of success.

"If by means of improved valves, etc., an approach to noiselessness can really be reached, as seems to be believed by not a few makers, a big step forward will be made. To strive to remedy the trouble at the exhaust end is to run the risk of encountering a boomerang. No one can avoid the conclusion that the exploded charge must find ready egress if back pressure is not to result. No matter how ingenious the construction of the muffler may be, it will almost certainly be regarded with suspicion. Loss of power will not be readily put up with; if there must be a choice of evils ninety-nine out of a hundred users will choose the noise—at least, until there is some pretty convincing evidence brought forth on the other side. The general public will welcome any diminution in the volume of sound emitted by the exhaust. Users, more discriminating, will first want to know whether it is an unmixed blessing."

In throttling a motor with inlet valves actuated by suction, it is a matter of great difficulty, if not an impossibility, to regulate by hand the admission of air to the mixing chamber in a way to secure an absolutely uniform mixture when the motor is running at far below its normal speed. To avoid this inconvenience, a new system of carbureter has been designed, in which this admission of air is regulated automatically by the engine, so that, as the mixture is always the same, and only varies in quantity, the motor will run at a low speed without danger of stopping through the admission of poor gas.

The first bicycle works in Japan are about to be started by a syndicate of eighteen Japanese financiers with a capital of 150,000 yen.

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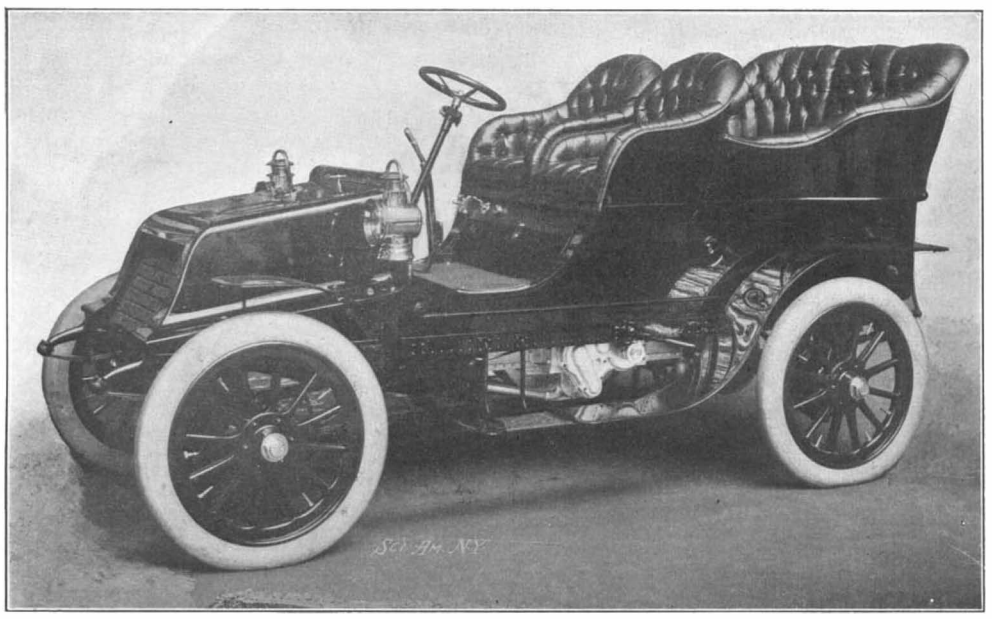
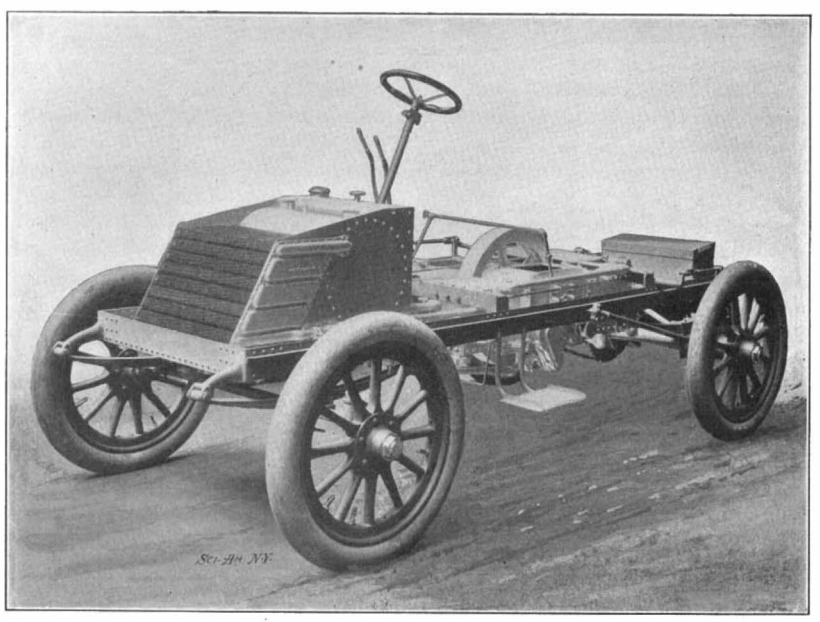
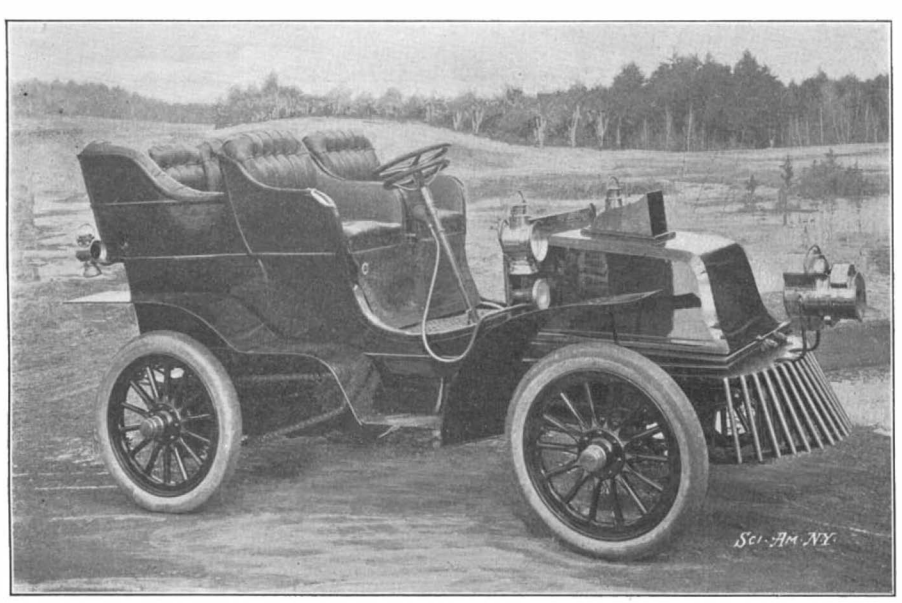


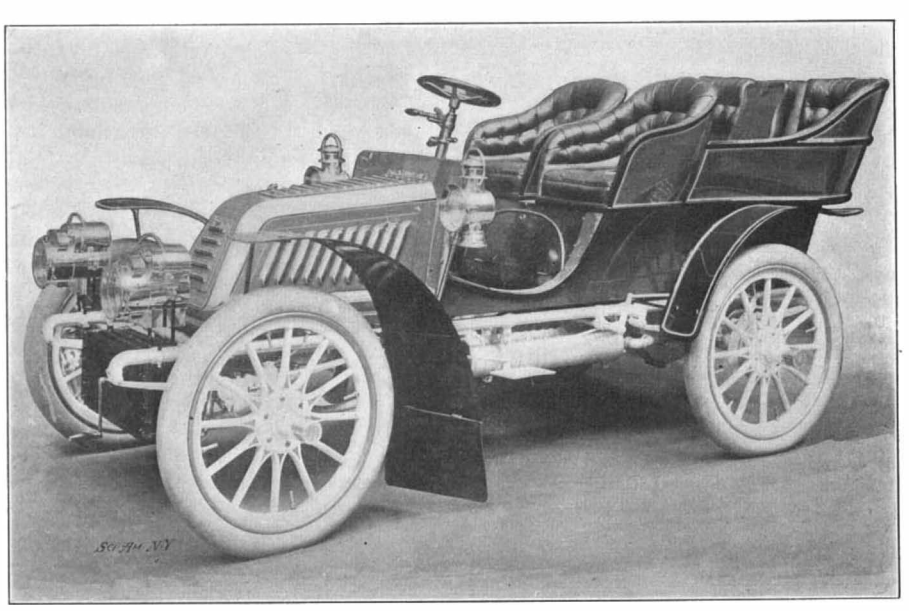
The Winton 20 H. P. Touring Car.



Chassis of Winton Touring Car.

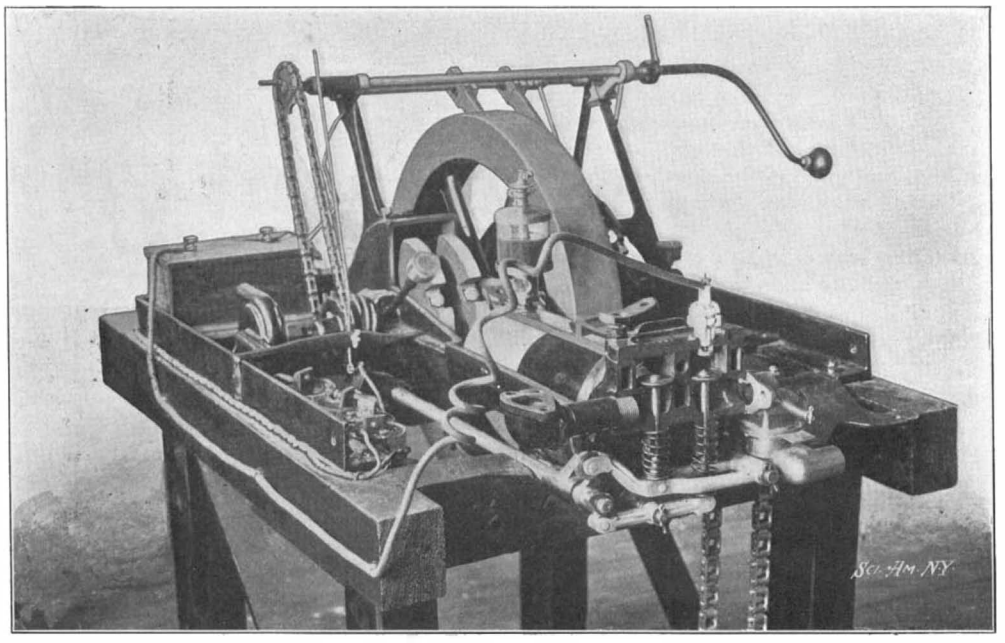


The Grout Steam Tonneau.

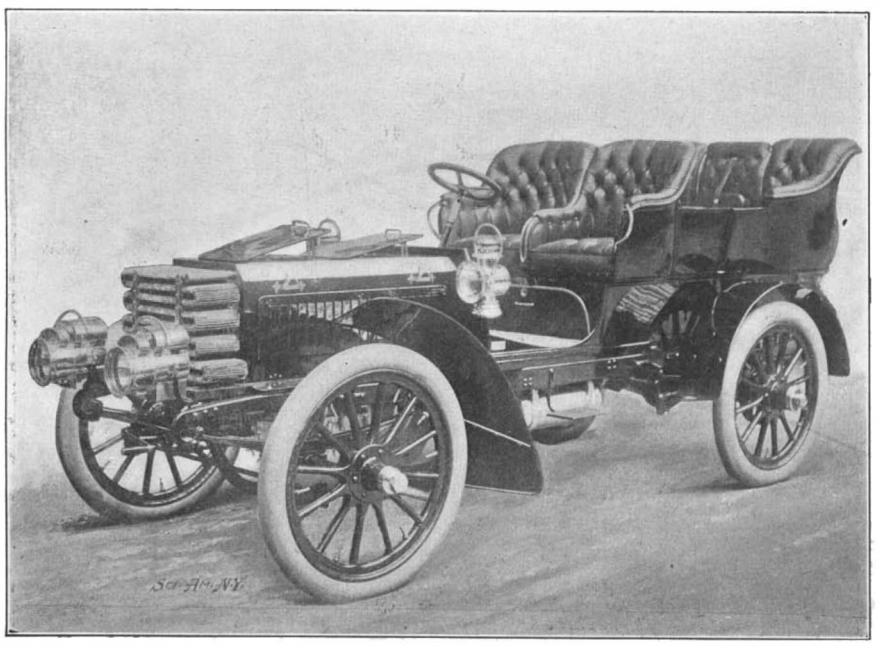


The Pierce "Arrow" Tonneau.

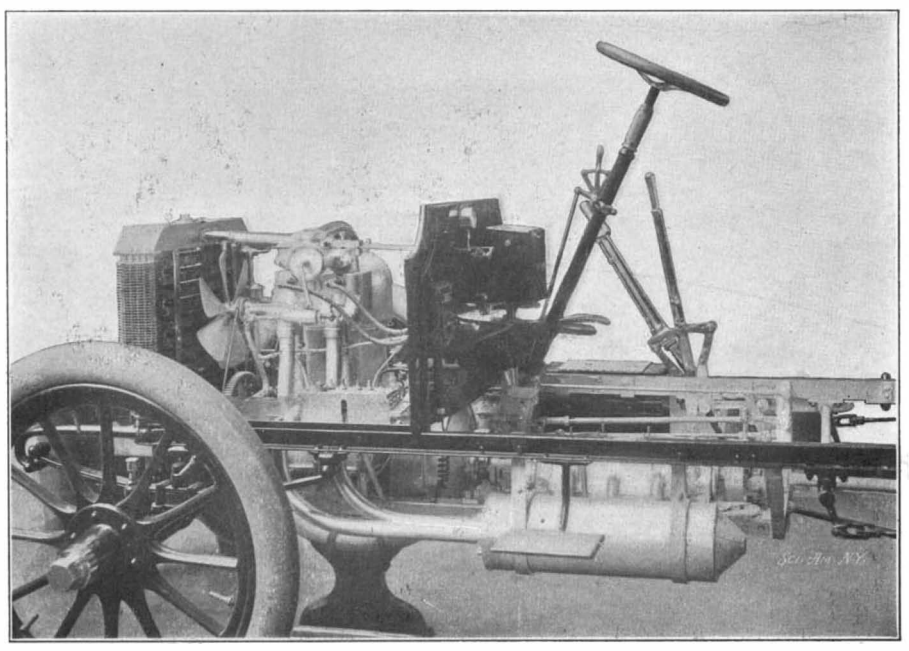
The Oldsmobile Brougham.



Oldsmobile Engine and Transmission.



The Peerless "King of the Belgians" Tonneau.



Chassis of Peerless Tonneau.

Photographs made especially for the SCIENTIFIC AMERICAN.

SOME 1903 MODELS.

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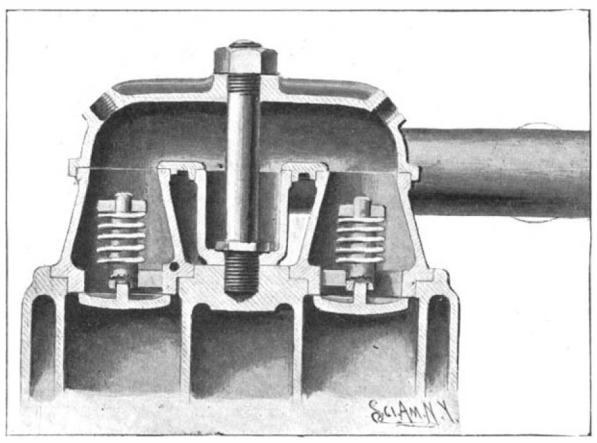
THE LOCOMOBILE GASOLINE CAR.

The Locomobile gasoline cars of this year, built after the designs of Mr. A. L. Riker, are characterized throughout by the greatest simplicity of parts and construction conformable with the attainment of the ends desired.

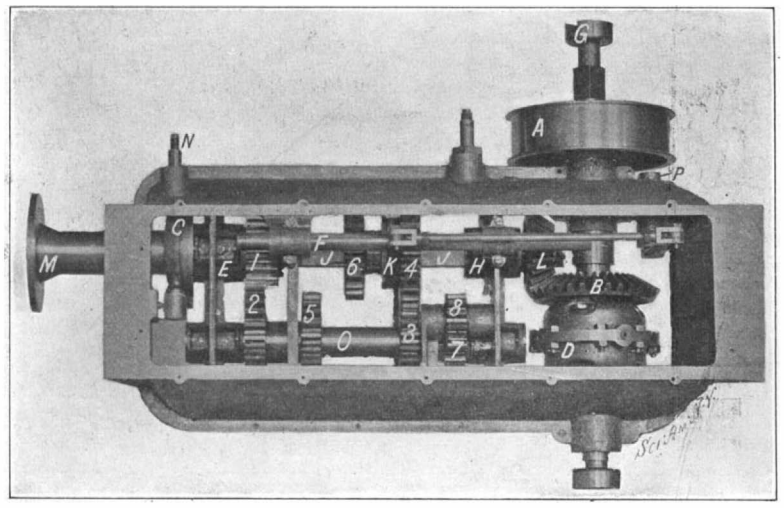
Two sizes of touring cars are being manufactured. These are a 16 horse power, four-cylinder, and a 9 horse power, two-cylinder car. The cylinders have a 4-inch bore and 5-inch stroke, and the motors make 900 R. P. M. when the cars are going 30 miles an hour. The horse power they develop is in reality greater than that at which they are rated, the larger engine having generated, when direct-connected with a dynamo and at a speed of 1,000 R. P. M., 21 electrical horse power.



METHOD OF SECURING INLET VALVES.

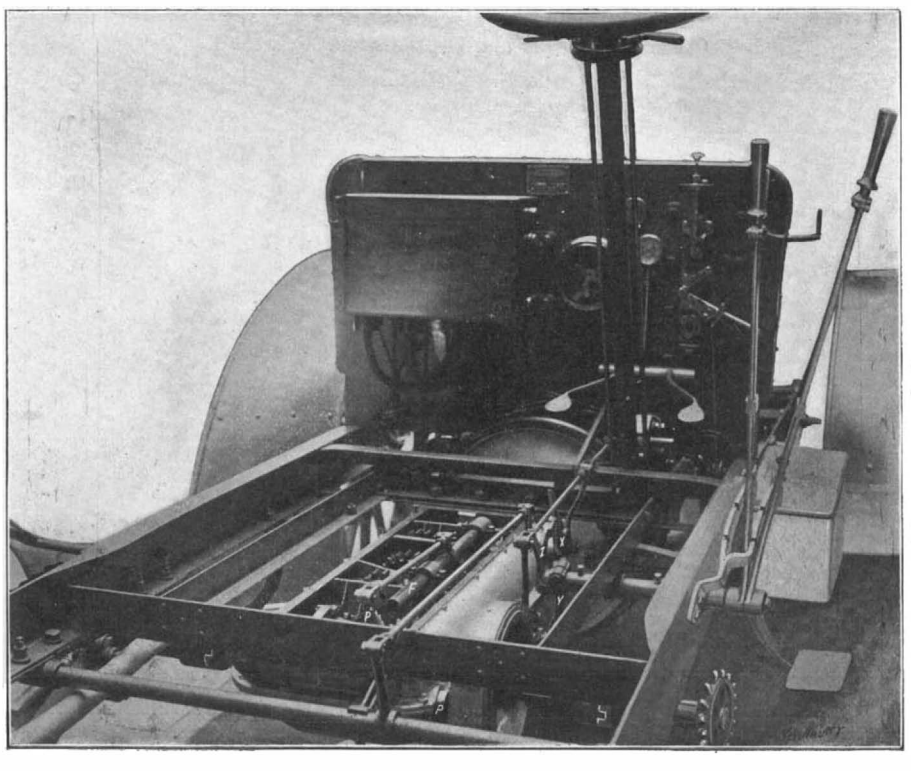
The main frame of the car is made of 4-inch channel steel, tapered down to a width of 2½ inches at the ends, which reduces the weight of the entire frame from 5¼ to 3½ pounds per foot. Within the main frame, and extending back to the cross angle iron at the back of the gear case, are two longitudinal angle irons on which the motor is mounted. These angle irons weigh less than the extra long brackets which would otherwise be needed on the motor would weigh; and they give a stiffer, stronger construction. As shown in our illustration, the four bronze brackets of the motor are bolted to them. The upper halves of the crank and gear cases are made of bronze and the lower halves of aluminium. The cylinders of the motor are cast integrally in pairs, and bolted to the crank case, as shown. Each pair has inlet and exhaust valves, the one directly above the other, in a valve chamber at the side. A conical gas entrance pipe or cap covers each inlet valve, the two caps being connected by a bridge pipe, which also fits over the branch of the main inlet pipe, located between the two valves. The bridge pipe is clamped in place by but one nut, by removing which the bridge pipe, conical caps, and inlet valves may be quickly removed. The spark plugs are of the single porcelain type, and, like every other part of the machine, are specially made after Mr. Riker's design. Very heavily insulated cables, coming from the secondary binding posts of the four encased spark coils on the dashboard, are held in brackets clamped to the motor, with their terminals an inch or two away from the spark plugs, but connected to them by brass chains. This makes a flexible connection that gives no pull on the plugs, while at the same time the benefits of the outside spark gap are obtained. The outside spark gap is a recent discovery credited to workmen in the Panhard factory. It was found that a plug which is short-circuited and will give no spark, will immediately do so regularly if the wire connecting with it is held a short distance away from the end of the plug, thus making an auxiliary air gap. Mr. Riker states that he discovered this fact nearly two years ago. He has embodied the principle in the chain connection here shown. At night, when the motor is running, sparks may be seen jumping along the chains. In the illustration, the exhaust valve stems and springs can be plainly seen below the valve chamber of the motor. The valves are opened and closed mechanically by cams on the two-to-one shaft, which is rotated by the large gear mounted on it and driven by a pinion having half as many teeth, on the crank shaft of the motor. (This gear is inclosed in the large casing in front of motor.) A lug on the cylinder wall, just below the exhaust valve spring, enables one to raise the spring with a lever, so as to withdraw the pin upon which the spring bears and allow the valve stem to slip through the spring, whereupon it can be removed through the inlet valve opening. This is an example of how convenience is considered in the minutest details of the car.

On a second shaft, parallel to the two-to-one cam shaft and driven by a small pinion meshing with the large gear of the latter, are the dynamo and centrifugal water-circulating pump. With this positive drive, the flow of water and of electricity is always assured. Two two-cell sets of 40 ampere-hour accumulators, carried in a box beside the step, furnish the sparking current. The set that is in use is constantly being charged by the dynamo, which is switched in circuit automatically as soon as it comes up to speed. If one set gets out of order from any cause, there is always the other to fall back upon. Four spark coils with vibrators, incased in the large box on the dashboard, complete the system; but another convenient feature that should be noted is, that in switching on the electricity to start the motor, the operator also turns on the lubricating oil. This is fed to the crank case by gravity, a short standpipe in the bottom of the latter carrying off the surplus. A ring, or groove, near the bottom of each cylinder, connected with the crank case by a passage, collects and delivers back to the latter any superfluous oil that is splashed up on the piston. The governor is operated by two jointed, weighted arms, thrown out by centrifugal force against the pull of two springs. The arms and springs are hung on pins *NN*, in lugs on gear, *G*. (See diagram.) The movement thus obtained, transmitted through arms, *AA*, serves to rotate sleeve, *S*, a certain distance. This sleeve projects forward and carries the commutator, *C*, for making and breaking the four primary circuits. The movement of the sleeve through its arc, therefore, serves to advance or retard the spark, by the corresponding movement it gives to the cam. Two long pins, *PP*, projecting back from the two arms, *AA*, of the sleeve through gear, *G*, pass loosely through holes in the governor shipper, *D*, which is revolubly mounted on the cam shaft, *W*, with a spiral groove in its hub, *H*. A pin in the shaft projects through this groove, and, when the sleeve, *S*, rotates the shipper, *D*, through the determined arc, the latter is moved along the shaft also by the spiral groove and pin, sliding, as it does so, on the driving pins, *PP*, and assuming the position shown by the dotted lines. Thus is obtained the

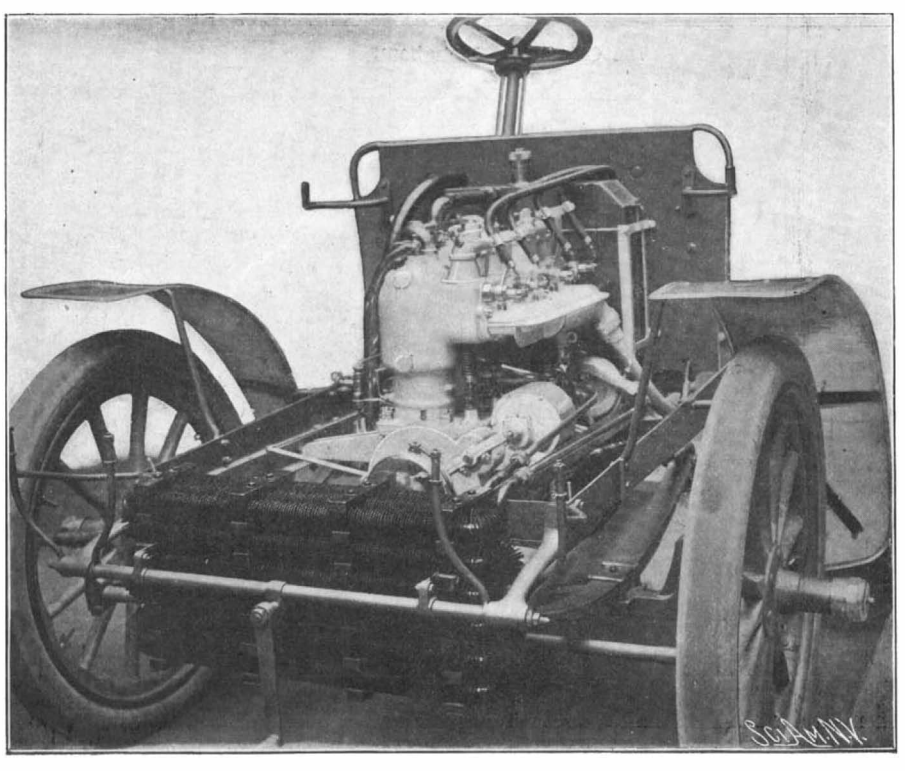


TRANSMISSION GEAR OF TOURING CAR.

16 H. P. LOCOMOBILE TOURING CAR.



CHASSIS OF LOCOMOBILE CAR.



MOTOR OF LOCOMOBILE CAR.

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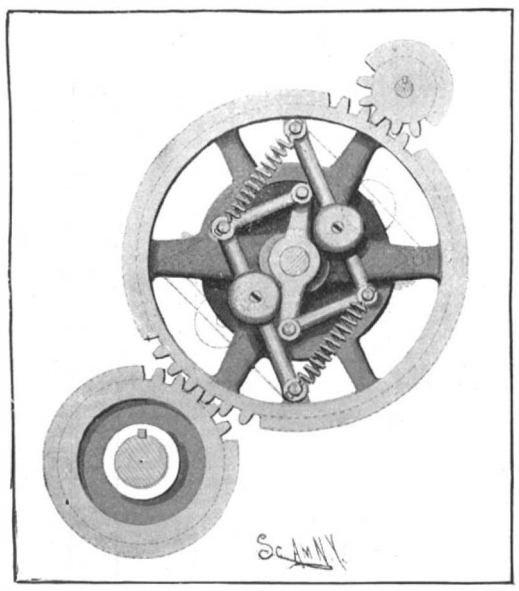
movement of the shipper, which is transmitted to the carbureter lever through the long lever pivoted in the casing of the gear and seen running across the front of the picture of the motor. A link connects this lever with that on the carbureter.

The carbureter is of the usual float-feed atomizer type. Inside it are two sleeves, one acting as the throttle and cutting down the mixture at the same time that it throttles the air; the other, an auxiliary throttle that the driver can set at any point at which it is desired to have the governor cut off. Beyond setting this throttle according to the speed at which he wishes to travel, the driver has nothing to do with the control of the motor. Moreover, the valves in the carbureter are so arranged that when the auxiliary throttle is wide open, the size of the port in the carbureter leading to the motor is the same as that of the inlet pipe, even when the governor throttle valve has shut off to its full extent. Consequently, the governor has no effect, and the motor will develop its full power.

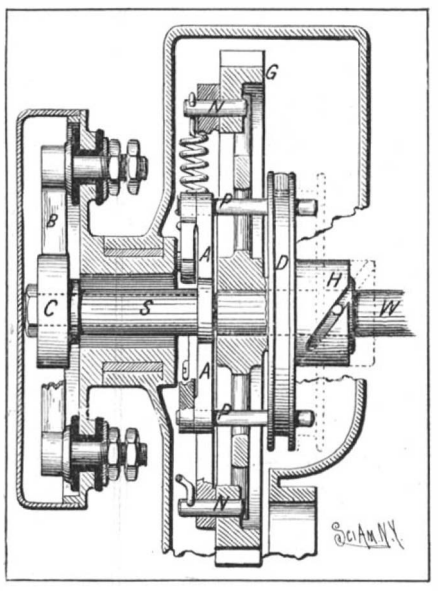
The transmission gear of the Riker machine is of the usual French type, giving three speeds forward and one reverse, with a direct drive from motor to countershaft on the high gear. Referring to the illustration of the gear, the reader will see its construction and main points. *M* is the sleeve and flange, bolted to the usual friction clutch in the flywheel of the motor. This sleeve has a square hole the greater part of its length, into which fits a short shaft extending through bearing, *E*, and terminating in a wide pinion, *I*. The shaft, *JJ*, also squared, has one bearing in pinion, *I*, and the other at *H*. Gears 4 and 6 are slid on it by means of shipper, *K*, and movable rod, *F*; and it drives the differential, *D*, on the countershaft, through the bevel pinion, *L*, and bevel gear, *B*. The side thrust of the bevel gear is taken up by a corrugated, propeller thrust bearing in the gear case. Parallel with the main shaft is another shaft, *O*, carrying gears 2, 5, 3, and 7, keyed to it. Gear 2 is always in mesh with pinion 1. Consequently, shaft *O* is always in motion when pinion 1 is turning. The illustration shows the position of the gear on the slow speed—1 driving 2, and 3 driving 4, which is squared on main shaft, *J*. The middle speed is obtained by sliding gears 6 and 4 along on *J* till 6 meshes with 5. For the high speed, 6 and 4 are slid still further to the left, when the teeth of pinion 1 engage with similar internal teeth cut in 6 on that side, and hence lock shaft, *J*, to the short driving shaft carrying 1. This gives the high speed. The reverse is obtained by means of an idle pinion 8, with which 4 meshes, and which is driven by gear 7. *C* is the shipper of the flywheel clutch, which is operated by the rotating rod, *N*. The bearing of the lever arm that moves the shipper, *K*, is seen in the case at *P*. The arrangement used makes it possible to have no sliding parts projecting through the gear case. *A* is the band brake drum, and *G* the female portion of the Oldham universal coupling employed to allow for any misalignment of the countershaft due to straining of the frame. The end of the shaft attached to the frame also has a grooved flange, while in the position in which the male floating member rests between them, their grooves are set at right angles. These universal couplings are plainly to be seen in the rear view of the chassis.

The car is steered by a wheel, connected to the steering knuckles of the front wheels through a worm gear and segment.

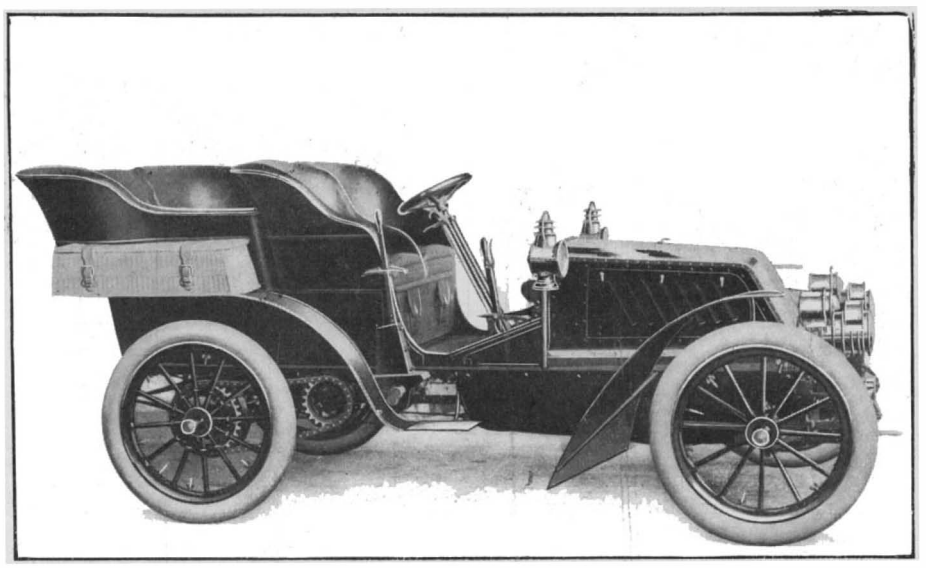
Two pedals and two levers control all the mechanism from the driver's seat. The pedal for the left foot draws forward the lever *X* by means of a rod connection, thus withdrawing the clutch as explained above. The right pedal does the same thing, but, having a greater movement, also applies the band brake, the lever of which is also connected to *X*. The shorter lever changes the gears, the rocker arm, *Y*, on its shaft being connected by a link to another depending arm, *P*, joined to the upwardly projecting arm, *P'*, within the case, which slides the shipper-carrying rod, *F*. The powerful band brakes on the rear wheels are set by the outer lever, which moves arm, *Z*, connected to the transverse brake shaft. The forwardly-projecting arm of *Z* pushes against a special arm on *X*, thus moving *X* forward sufficiently to throw out the clutch before the brakes are applied. The cars are fitted with artillery wood wheels having plain bearings. The cap on each wheel forms an oil reservoir, and in the end of the box is a curved groove that scoops up the oil and leads it to the oil groove on top of the axle. The only balls used throughout the whole machine are in a thrust ring on the clutch, in use only when the clutch is withdrawn. The wheels are fitted with 34 x 3½ inch detachable tires. The wheel-base of the large car is 84 inches; the tread is standard; and its weight complete is 2,150 pounds. The chassis can be fitted with any style of body desired to suit the taste of the purchaser.



CENTRIFUGAL GOVERNOR OF RIKER CAR.



CROSS-SECTION OF GOVERNOR.



COLUMBIA 24 H. P. TOURING CAR.

THE COLUMBIA GASOLINE TONNEAU.

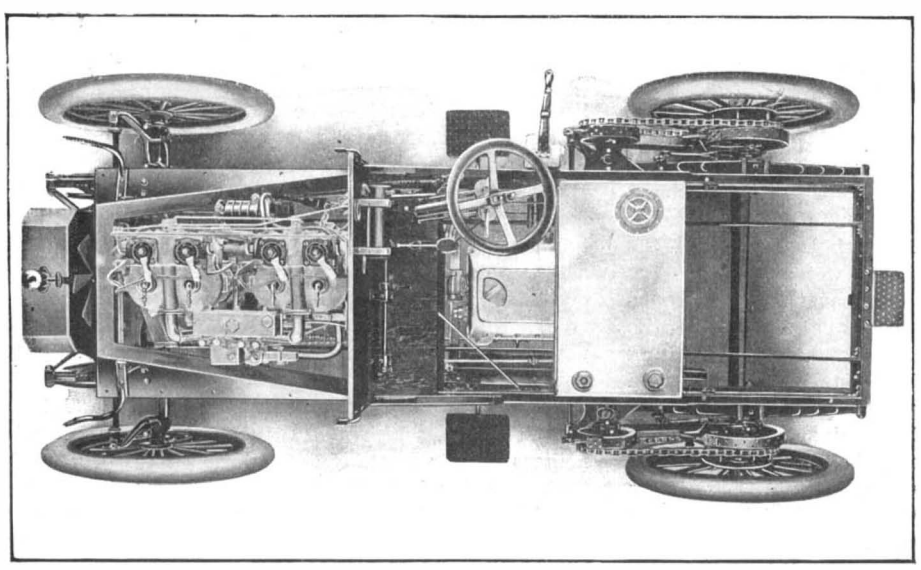
The new gasoline automobile that is being manufactured this year by the Electric Vehicle Company, of Hartford, Conn., is the invention of Mr. Fred A. Law. The chief idea of the inventor in designing it, was instant accessibility of all parts that may require attention.

The main clutch is of the usual leather-faced, flywheel type, having eight brass spring-pressed shoes or plungers in its face. By means of the novel arrangement of plunger shoes, it is possible to slip the clutch without damaging its leather facing, which is 2 inches wide, and subject to very slight wear.

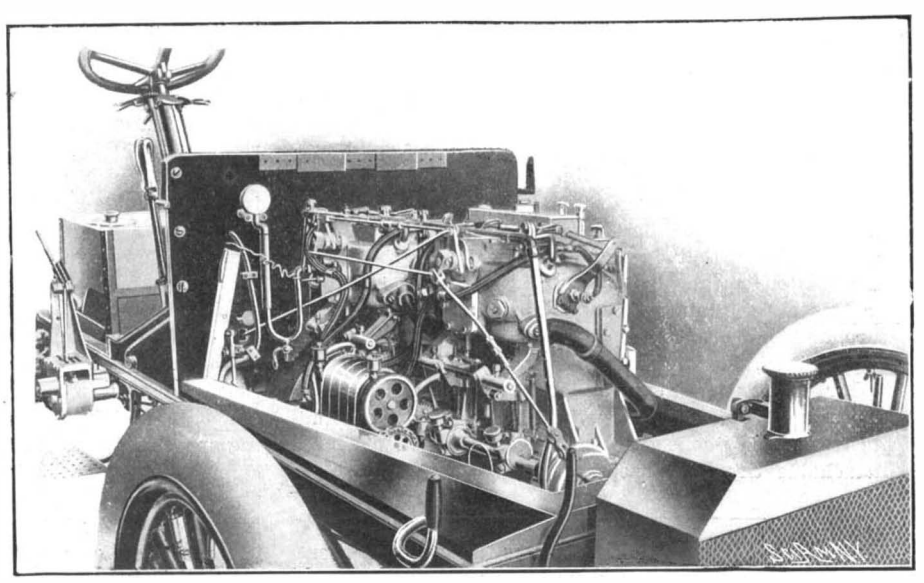
The flywheel clutch is connected to the main driving shaft through a sort of universal joint; and the transmission gears driven by this shaft are of the usual sliding French type, giving four speeds ahead and one reverse, with a direct drive to the countershaft on the high gear. This latter shaft is driven through the usual bevel gear with ball-bearing side thrust, and is fitted with a special jaw clutch by which both rear wheels may be driven together without the differential operating, if the machine should become stuck with one wheel on a muddy or icy patch of road, and the other on more favorable ground. By jacking up the rear axle and throwing in this clutch, one rear wheel can be belted to a dynamo or any other machinery it is desired to drive, and the automobile be made to serve as a stationary source of power. The countershaft has a band brake drum and radius rod on each end, beside the driving sprockets; and the rear wheels are also fitted with band brakes operated by the short lever located beside the steering column. The brake drum, sprocket, and clamping ring which is fastened to the spokes, form three concentric rings of the same size, connected together by pins. The body is hung on a pivot on the rear springs, so that the latter will not be strained if tilted a little by the radius rods in tightening the chains. Wheel steering through rack and steel pinion and a universally jointed connection to the steering knuckles is employed.

The transmission gear has two sets of sliding gears, operated by a single lever. By moving the lever back and forth in the two legs of an H-shaped slot, any gear desired may be thrown in. The lever can be moved to the oil position, or *vice versa*, from any gear it may be on, without passing through any of the other gears. This, although the movement of the lever is not quite so simple as a straightforward movement, is advantageous, as any gear desired can be immediately selected. An interlocking arrangement makes it impossible for any other gears than the ones in use to engage.

The motor has four 5 x 5-inch cylinders, and is rated at 20 horse power at 900 revolutions per minute. It is said to have developed 26 horse power in a brake test, however. The cylin-



CHASSIS OF COLUMBIA TOURING CAR.



MOTOR OF COLUMBIA TOURING CAR.

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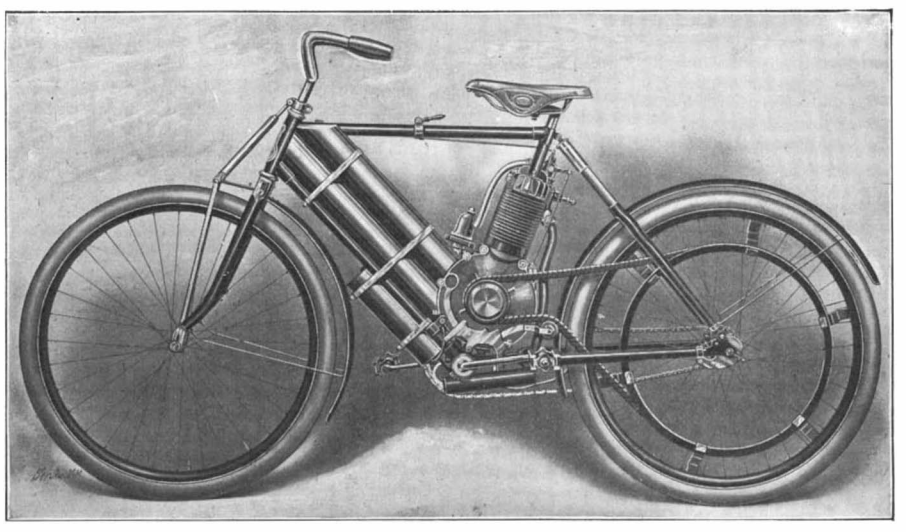
ders are cast integrally, in pairs, and aluminium plates on the sides, covering openings into the water jackets, offer the advantage that they would give way, should the water freeze in the cylinders in winter, and hence protect the latter from cracking. In the plan view of the chassis, the four inlet valves, with their handles for removing, held from turning by springs, can be seen. The side view of the motor shows one of the spark plugs similarly fitted. The small eccentrics on the main shaft are also visible. Two springs, depending from a cross arm on the valve stem, bind the latter to the eccentric rod and hold the valve down on its seat. The eccentric rod raises the valve through a small bell crank, and the valve follows the motion of the latter in closing, being bound to it by the two springs till the valve seats, when the bell crank moves away and the pressure of the springs clamps the valve to its seat. The arrangement causes the valves to close quietly and without the blow that is usual with the ordinary exhaust valves.

The inclined rod at the front of the motor connects the shipper of the ball governor on the motor shaft with the throttle valves for each pair of cylinders. Rotating cylindrical valves are used, having long slots that match similar slots in the sleeves in which they turn. The governor rotates the valve sufficiently entirely to close these slots, which are tapered on the cutting off edge, so as to close the ports gradually. By rotating the sleeves sufficiently to correspond to the valve movement, which may be done by a small hand lever on the steering column, the governor can be thrown out of action completely, or the motor speed be partially accelerated, as desired.

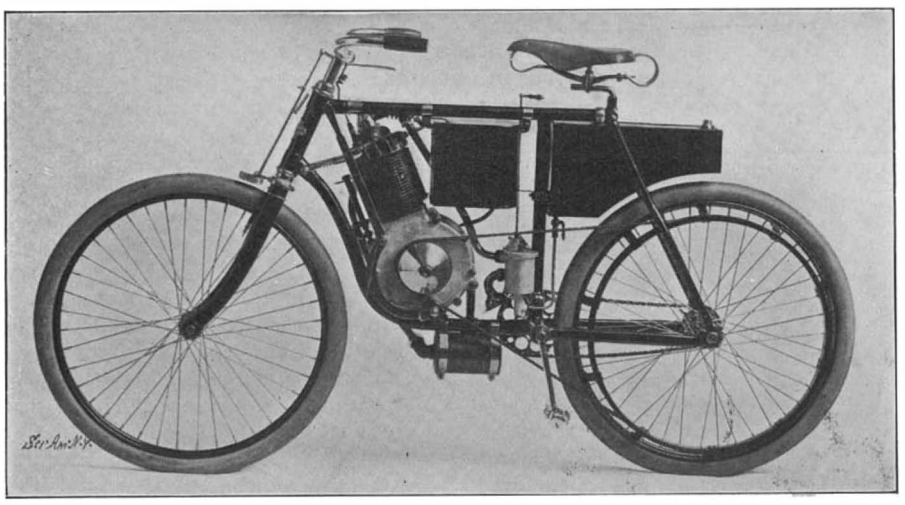
The German Eisemann magneto system of ignition is employed. A rotary gear pump circulates the water through the engine jackets and radiator, behind which a fan makes a forced draft. Strainers are placed in the water and gasoline pipes, and are readily removable for cleaning. The spraying nozzle of the carbureter may also be easily removed. The auxiliary air pipe of the latter is fitted with a weighted butterfly valve that opens proportionally as the speed and suction of the pistons increase. This is intended to maintain the mixture constant. The spark, the mixture, and the throttle are all also controllable from the seat by levers on the steering pillar.

Our illustration gives a good idea of the general appearance of the car. Its wheel base is 93 inches, and its tread is 56 inches. Wood wheels shod with 4-inch detachable tires are used.

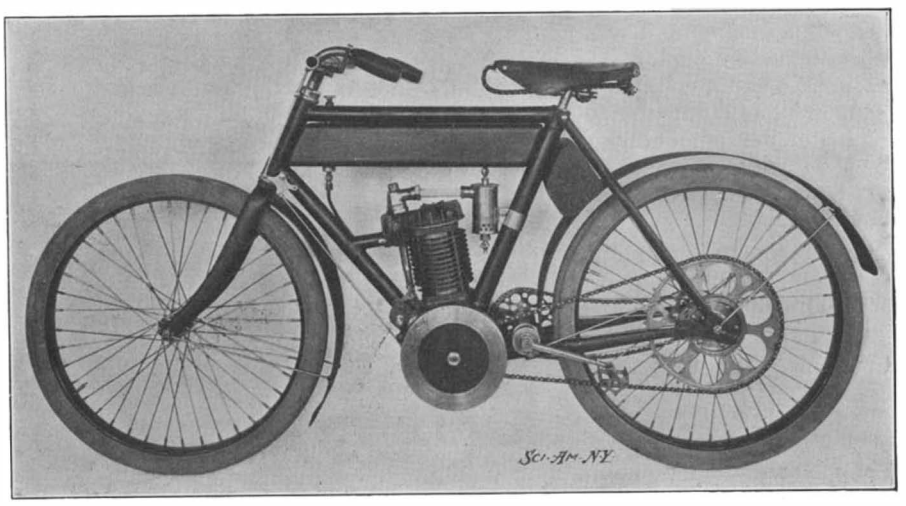
The "Indian" Motor Bicycle.



The Thomas Motor Bicycle.



The "Orient" Motor Bicycle.



The Metz Motor Bicycle.

THE LATEST TYPES OF MOTOR BICYCLES.

The increasing interest in motor bicycles manifested of late among cyclists is directly attributable to the numerous improvements which have brought various makes of these machines up to a high standard of excellence. These improvements are so many and varied that we cannot attempt to discuss them all in the brief space at our disposal. We will, however, mention some prominent types of motor bicycles and review their principal features.

The Thomas "Auto-Bi" shown in our first illustration comprises a number of important details. The cushion spring fork absorbs all concussions and handle-bar vibration, relieving strain on the mechanism and frame, and eliminating all fear of broken forks, which has been dreaded so much in the past. The machine is driven by a 2½ horse power motor through a peculiarly constructed belt. By an ingenious combination of leather and steel, this belt is made to have the unstretchable qualities of steel, while preserving all the elasticity of leather. This to a large extent reduces strain on the motor and tires, and prevents skidding, at the same time increasing the speed of the motor and the hill-climbing capacity of the bicycle. The machine is provided with large flywheels. These, as well as the bearings and the connecting rods, are one-piece forgings. The bearings are all large, and are hardened and ground. All details are built for strength and durability, and yet the total weight of the machine is but 95 pounds.

A great deal of ingenuity has been exercised on the "Metz" motor bicycle in arranging the necessary parts in the most compact manner. Tubing of very large diameter has been used for the purpose of resisting strains peculiar to motor-driven bicycles. At the same time the inner space of the frame is utilized for various purposes. The top frame tube serves as a reservoir for lubricating oil, while the induction coil is neatly incased in the seat mast, where it is safe from injury. The lower tube serves as a muffler, through which burnt gases pass from the cylinder. The motor crank case is built integrally with the frame of the bicycle, and this, while reducing weight, adds to the staunchness of the machine and prevents those numerous troubles attributable to a continual vibration of the motor. The flywheels are placed outside of the crank case, which allows them to be of larger diameter than is usual, and therefore to have greater effect. The driving sprocket is fastened to the crank shaft by a flexible connection. This flexibility may be adjusted to any desired degree of tension. The durability of the chain is increased, owing to its relief from violent impulses of the motor. Means are provided for oiling the motor while riding. Another important feature is to be found in the constant-level, float-feed carbureter. Three spray nozzles are provided at equi-distant points around the mixing chamber which encircles the float chamber, so that whether the machine be going up or down hill, a proper suction level is kept. There is also a trap for catching water and sediment in the gasoline.

The "Indian" motocycle is another type of machine which has become quite popular in the cycling world. Great care has been exercised in the construction of the motor used in this machine, and, by thorough testing under all conditions, it has been brought up to a high state of efficiency. The problem of power transmission to the rear wheel is solved by using two chains; one chain of short length is run from the motor to a countershaft mounted on a hanger bracket, and the other chain transmits power from this countershaft to the rear wheel. In the hanger is an eccentric for adjusting the chains. A speed reduction is made on each chain, and they are so constructed and arranged that it is impossible to break either one of them, even though the speed lever be thrown over to its full limit at the start. The entire power of the motor is communicated to the rear wheel, and a steady positive drive is obtained without any slip whatever. The "Indian" motocycle has one lever control. This is important to the beginner and even to the experienced cyclist, for in threading one's way through a crowded street, even the best of operators is liable to be confused by a multiplicity of levers. The single lever on this bicycle starts and stops the machine and increases its speed. The same lever lifts the exhaust valve, permitting the machine to be started with but slight compression in the cylinder, and it also governs the time of the spark. The carbureter used on the "Indian" motocycle, which is constructed on the float and constant-level principle, embodies a number of new and important details. It allows of a steady flow of gasoline under all conditions of travel. The air is taken in through a hood at the bottom, and is adjusted by a regulator at the top. It has been found that a better mixture is obtained by taking the hot air off the cylinder. The gas lever, which can be operated without taking the hands from the bars, is arranged to admit a larger flow of gas into the engine when extra speed or power is required. The machine has a very narrow tread, which offers the advantage of a nearly natural position when riding. Its total weight is only 98 pounds.

In contrast to this light machine is the heavy "Orient" motor bicycle, which weighs about 160 pounds. The makers of this machine have worked on the principle that even the lightest of motocycles is too heavy to pedal in case of a break in the motor, and that consequently the reduction of weight is not of such importance as a heavy but strong construction, which would prevent such accidents and at the same time furnish

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The twelfth census, 1900, divulges the fact that there were 27,029 photographers enumerated in the United States, of whom 23,442 were males and 3,587 females.

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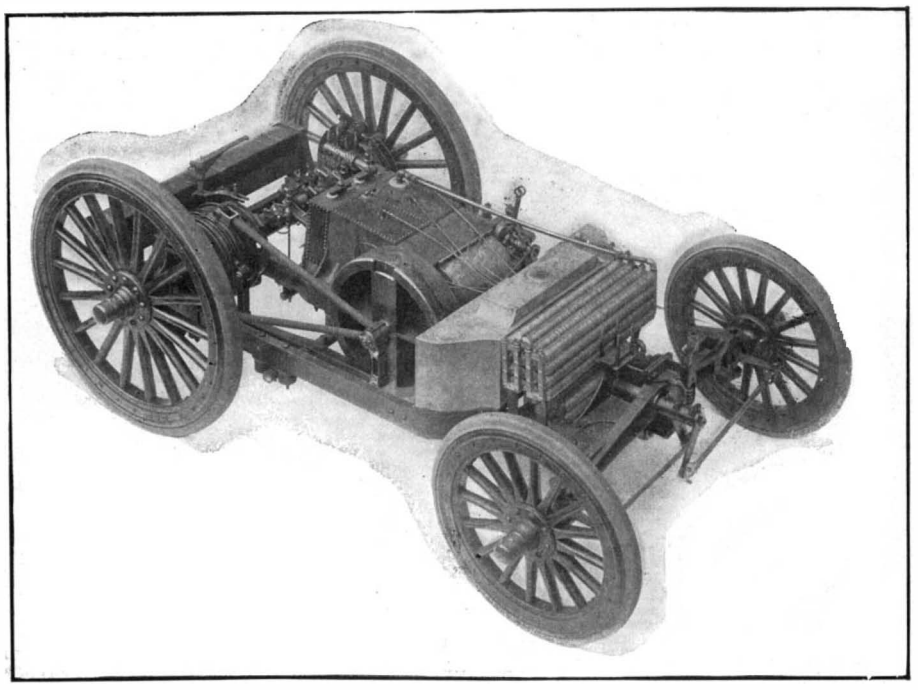
sufficient power to drive the machine over the worst of roads by motor power alone. The weight of the "Orient" motor bicycle serves also to absorb the vibration of the motor and prevent jarring of the machine and fatigue of the rider. A three or four horse power motor, as desired, is used for driving the machine. Great care has been exercised in the construction of these motors. The very best material is used, because weight is not a limiting item. Fluted copper rings are fitted over the cylinder to radiate the heat, instead of the cast flanges that are generally employed. The accuracy and reliability of the carbureter used on this bicycle have had much to do with the success of this type of machine. The spark plug is provided with porcelain insulation, which has been found to be one of the best materials for this purpose. Power is transmitted to the rear wheel through a leather belt especially prepared and heavily stitched. This offers a flat plane surface, which is very reliable. The motor is thrown in or out of gear by means of a jockey pulley on a curved arm forming part of a handle, as shown.



CHASSIS OF UNION MOTOR TRUCK, SHOWING SIMPLICITY OF DRIVING MECHANISM.

A NOVEL TRANSMISSION DEVICE FOR GASOLINE AUTOMOBILES.

Our illustrations show a new transmission device brought out by the Union Motor Truck Company, of Philadelphia, Pa., and first exhibited at the 1903 New York Automobile Show. This device solves, in a simple manner, the double problem of connecting a gasoline motor directly to the driving axle of an automobile, and likewise of furnishing a speed-changing arrangement by which the speed of rotation of the rear axle can be varied without varying that of the motor. The chassis is made up of a U-shaped steel frame carrying a two-cylinder, 12 horse power motor, with a slidable crank-pin in the flywheel, direct connected to a roller ratchet device on the rear axle. When the motor is being started or is running idle, the crank-pin is in the center of the fly-wheel and the connecting rods are at rest. The wagon is started by sliding the crank-pin slightly off the center of the fly-wheel, which gives a slight reciprocating motion to the connecting rods, causing them to turn the rear axle by the series of impulses they give it through the medium of the roller ratchet. A slight throw of the crank-pin gives short, extremely powerful impulses, while a longer throw increases the duration of the impulses and conduces to higher speed. The operation of the roller ratchet is virtually the same as that of the coaster brake on a bicycle, with the exception, however, that the former may be made to propel the vehicle backward as well as forward and may be thrown out of action when desired.

Referring to the diagram, the reader will see the construction of the principal parts of the mechanism. The crank-pin is on a slide in the flywheel, which is fastened to a piston moving in a cylinder in the fly-wheel casting. A powerful spring holds the piston normally, so that the crank-pin is exactly on the center of the flywheel. The crank shaft is hollow, and has a passage opening through a check valve into the top of the cylinder. There are two other valves (not shown) for the purpose of emptying the cylinder slowly or quickly, as desired. Oil is the fluid used for moving the piston, the oil being forced through the crank shaft by a plunger, which is started or stopped by throwing in or out a small friction clutch. The starting and stopping of the pump, the opening of the two oil relief valves, and the application of a powerful band brake to the differential drum are all accomplished by moving a single lever through an arc of 40 deg. When coasting, the motor can be thrown out of gear temporarily by setting the roller ratchet in the neutral position. The ratchet is instantly reversible also at any speed in case of extreme necessity.

The details of the roller ratchet can be readily comprehended from our diagram. A steel hub 8 or 12 inches long by 7 inches in diameter is keyed to the axle. On the periphery of this hub there are 12 longitudinal hollows ⅛ inch deep by ¾ inch wide at the bottom, with sides flaring out to a width of 1¾ inches at the circumference of the hub, and forming an angle of about 10 deg. with a tangent to it at the point of intersection. In the hollows are placed ⅝-inch hardened tool steel rollers, 3½ inches long. Two or three sets of these rollers are placed end to end, properly spaced and separated by a slotted bronze cage, *C*, according as two or three connecting rods are used. The guiding cage of the rollers fits loosely over the steel hub, and is but ½-inch thick, thus allowing the rollers to project 1-16 inch above and below it. It is keyed to the hub with two keys, *K*, wide and straight where they fit in the latter, but having a narrow feather

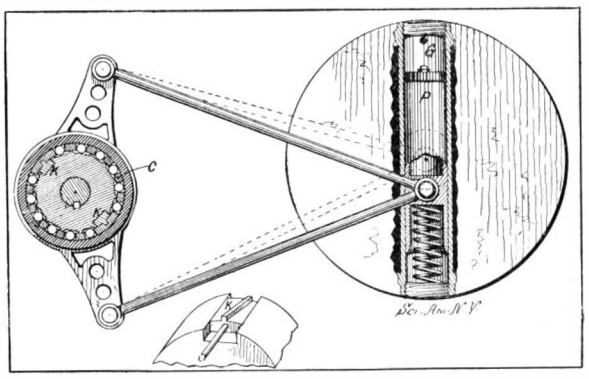


DIAGRAM OF THE POWER-TRANSMITTING DEVICE.

running at an angle across their surfaces, which slides in a corresponding groove in the cage. By sliding the key sideways in the hub, therefore, the cage is made to revolve around it slightly in one direction or the other (about ½ inch each way), and thus to move the rollers till they jam between the inclined portion of the hollows in the hub and the outside sleeve which encircles them and to which is fastened the connecting rod. The push or pull of the rod is then transmitted directly through the jammed rollers to the hub. Upon the return stroke of the rod, the rollers slide back off the incline sufficiently to free themselves and allow the sleeve to roll back over them. In the center, or neutral position, it can move either way without becoming locked, while the forward and reverse movements are obtained by sliding the cage and rollers either forward or backward upon the surface of the hub. There are as many separate sleeves and sets of rollers as there are connecting rods, three being the number now used. This gives three power impulses per revolution to the axle and drives it very steadily. As the rollers run in oil, they are noiseless, and as all the wearing surfaces are of the best hardened steel, the wear is found to be very slight. An experimental truck has been in operation for two years and has shown the wear of the roller ratchet to be almost inappreciable.

The company expect to have a truck in the commercial vehicle contest of the Automobile Club of America this spring, and its operation will no doubt be watched with interest by many.

UNION GASOLINE MOTOR TRUCK, SHOWING CONNECTING RODS FROM MOTOR TO REAR AXLE.

The Manufacture of the Deadly Dart Poison of the Sarawak Indians.

A close investigation has been made by Mr. C. G. Seligmann into the manufacture of the deadly poison used for darts by the natives of the Baran district of Sarawak in the course of a visit to Long Tamata on the Barem River. This poison, which is of vegetable origin, is generally known among the up-country tribes of this region by the name "ipoh." The poison is a nitrogen-free glucoside which affects the muscle of the heart and the central nervous system of the individual who is struck by a dart. It is a poison existing in its raw state, being the sap of the upas tree. The process of collecting the poison is very simple. Upon the bark of the upas tree a number of little channels are cut by means of a special gouge, extending in oblique directions, and all converging at their lower points into one vertical channel. The sap thus tapped by this scoring runs down the oblique cuts into the vertical channel, and is there collected in tubes of bamboo. In its raw condition the upas sap is of a yellowish white color, and bitter to the palate. Shortly after exposure to the air, it darkens in color and becomes sticky, and in course of time develops to brownish black. The juice is subsequently submitted to a prolonged boiling, the vessels for this purpose being of an extremely primitive nature, since they are fashioned from palm leaves. The upas tree sap is poured into these vessels, which are then suspended a few feet above a fire. The boiling process is somewhat protracted and during the whole time the sap is constantly stirred. During this operation the liquid is transformed into a thick, viscid mass, and in this condition it is withdrawn from the fire and set on one side to cool. When cold, the sap is a solid, hard, yet brittle substance, though before it is quite set the leaf is rolled up with its soft contents, the two ends tied with rattan and the poison thus kept until required.

The darts, which are projected by the natives through blowpipes, consist of strips of palm wood from 20 to 30 cm. in length, are pointed at one end, and a quantity of the poison is then removed from its palm leaf receptacle, and ground up until it is of the consistency of flour. It is then mixed with water and stirred up until it becomes a thin paste, which is smeared upon the points of the darts. The process of preparation takes place before a fire, and when completed the darts are placed with their points toward the fire, until the ipoh has dried into the wood. In the case of the darts that are required for the large game, the point of the weapon is split open, and a thin metal wedge or plate is inserted, and the whole point is then smeared with the poison. The opposite end of the dart comprises a small conical butt made of the soft pith of the sago palm. The darts are carried in small bamboo quivers, points downward, fixed into the loin cloth of the native, with the points protected by a piece of animal skin.

Improvements under way by the railroads of the United States aggregate nearly $400,000,000.

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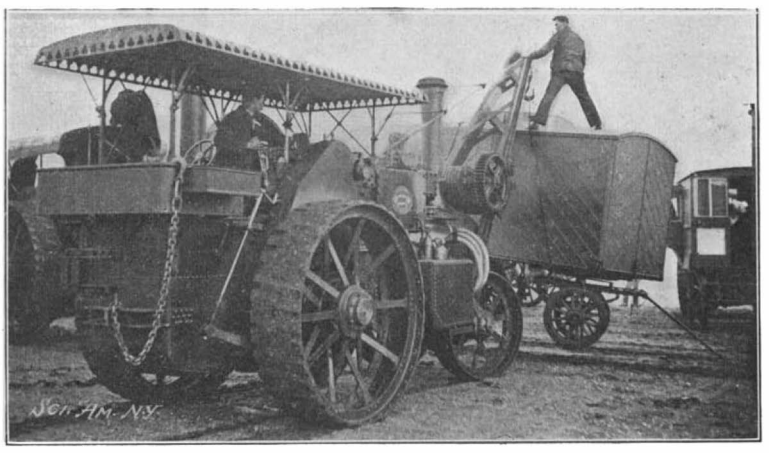
THE AUTOMOBILE IN WARFARE.

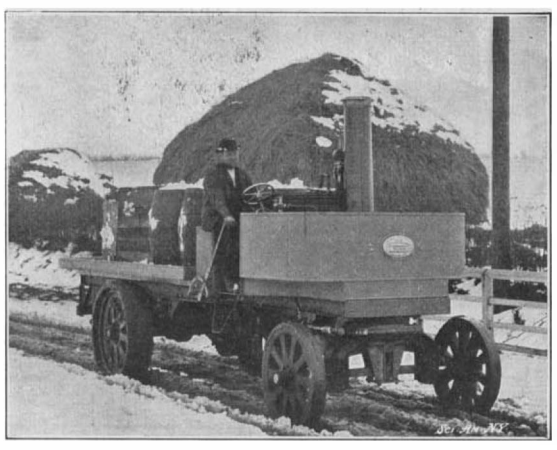
EXPERIENCES IN THE SOUTH AFRICAN CAMPAIGN.

BY HERBERT C. FYFE. LONDON.

Although traction engines have been used for military purposes at Chatham for some years past, they have not until quite recently been used by British authorities to any considerable extent in the field. In August, 1897, a trial was made in Long Valley at Aldershot, of one of the latest types of road locomotives, fitted with spring gear on both hind and front wheels, and also with the three road speeds. With this engine it was proved that stores could be taken from Aldershot to Salisbury Plain—a distance of about 60 miles—in a day; that it could easily travel at the rate of 8 miles an hour, and, when necessary to get out of the way of troops, at the rate of 12 miles an hour. At the slowest speed it dragged a gross load of 80 tons on the level, and traveled 17 miles without a fresh supply of water.



Lifting a Van.



A Wagon Built for the German Army.

This road locomotive was fitted with an independent donkey pump for filling tanks, horse troughs, or its own boiler. It was also intended to be used for driving centrifugal pumps and electric dynamos for traveling with a captive balloon.

One of the most extraordinary military parades ever seen was held on the famous Long Valley at Aldershot at the end of October, 1899, when sixteen traction engines supplied by Aveling & Porter, Ltd., Charles Burrell & Sons, Ltd., John Fowler & Co., Ltd., and J. &. H. McLaren, and between thirty and forty trucks were inspected and tested before their embarkation for South Africa. The engines were of various sizes and types, and the trucks were built to convey all possible war material, from loose grain to iron pipes. There were present to see the trials the Duke of Connaught, Prince Louis Napoleon and Prince Victor Napoleon. The Long Valley, with its great stretches of sand and rock, was admirably suited to the trials, as similar country had to be traversed in South Africa. The engines with trains of trucks were started off across country, taking hillock and ditch in their way in marvelous fashion. Some of the ditches had steep banks between two and three feet, yet these were negotiated with safety; and although the wheels sank often to the hub in wet ground at the bottom of the ditches, yet nothing stopped the engines' progress. A speed of eight miles an hour was obtained, and the display ended with a "march past."

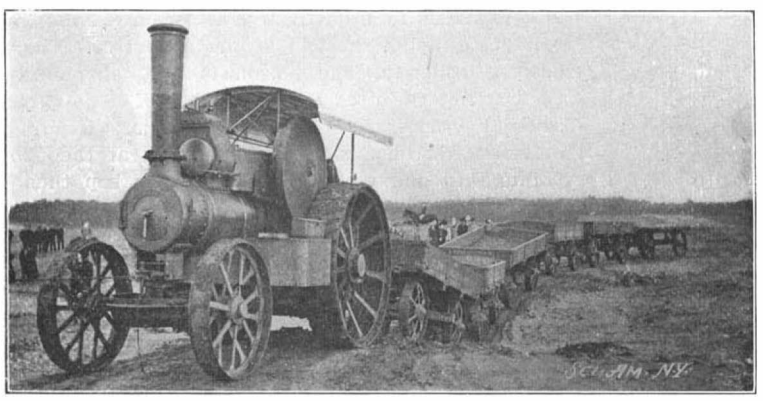
The utility of the crane jib, which sometimes forms part of the equipment of engines of this type, was amply demonstrated. There was no difficulty in thereby removing from a train of trucks one which was supposed to be injured, Messrs. McLaren's crane engine easily lifting it out of the way. Then it was shown how readily one engine could haul another engine with its train out of a bad place by means of a steel hawser, should it stick and remain fast. The largest of the engines weighed some 15 tons, it drew from 30 to 40 tons, carried water enough for a 17-mile run without stopping, and traveled 30 to 40 miles a day. They were provided with coal trucks, and with a sleeping car for the use of the engineers in charge.

In all some thirty traction engines were shipped from Southampton for the Cape. They were intended for use for winding loads over rivers and swamps and up precipitous places. Accounts from South Africa showed how valuable they have been for these purposes. They have also been employed to pull the new "trenching plow," two of which were sent to the front. This gigantic implement cuts a furrow 30 inches deep on the solid and 30 inches wide, and this enormous work is done by putting a pulley on the plow and anchoring one end of the rope, so that the pull on the plow is doubled. Steam plows are usually used for vine and tree planting, but in Africa they were used for making shelter trenches, and also ditches along the sides of the roads. (Descriptions of these plows appear in this week's Scientific American Supplement.)

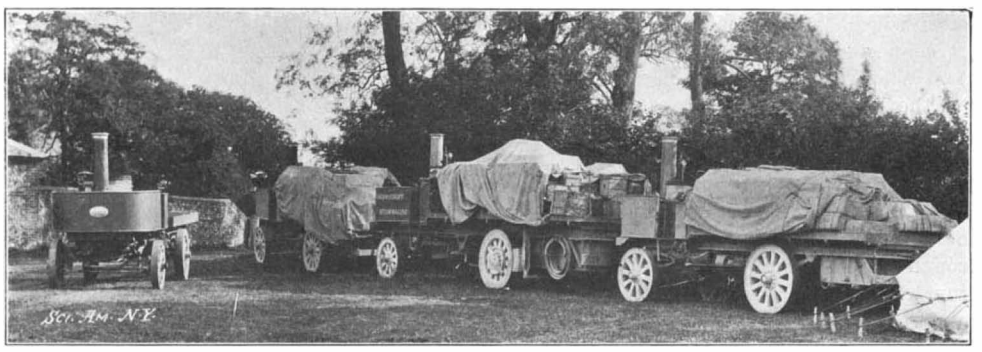
The "Traction Engine Brigade" was attached to the corps of Royal Engineers and figured in the army list as "45 Company S. Africa (Fortress) Steam Road Transport." Naturally on their arrival in Durban the engines had to be fitted together, and this took some little time, but as soon as possible they were sent up by rail to Frere and Chieveley.

Writing from Frere Camp on January 2, 1900, Mr. Bennet Burleigh says:

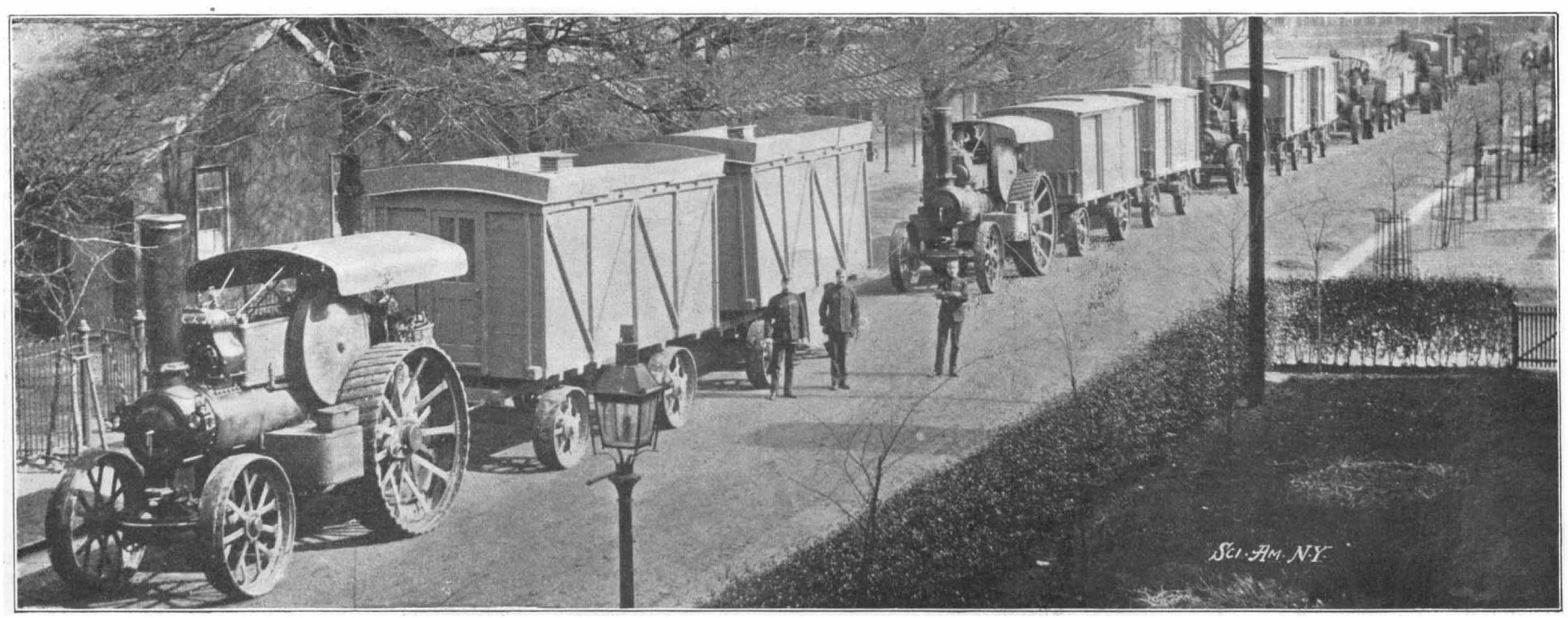
"Without them the troops would require an astounding length of ox and mule wagons. The despised ox-wagon is slow and sure. Its infallible drawbacks are that it occupies a considerable length of road, requires much guarding with many attendants, and can only be depended upon to haul not more than 600 pounds. Nay, more; if the teams are to carry their own forage, the power of hauling is limited to something like 50 miles. Were the army entirely dependent upon trek ox-wagons the 1,660 of them, the inconsiderable number for conveying the munitions of the army, would stretch along several miles of road. It will be another affair if the dry weather continues, and any great use can be made of the traction engines. They require few attendants, don't gibe, and each can easily haul 12 tons. Yesterday and to-day these wheeling puffing Billies have been running to and fro, transporting stores from the railway siding to the respective brigade camp—one of which, Hart's, is two miles away. They leisurely descend into spruits, roll across and wheel up stiff, long climbs like flies walking up a wall.



Hauling a Train Over a Gully.



Thornycroft Wagons at Aldershot Maneuvers.



A Train of Transport Engines and Wagons on the Road from Aldershot to Port for Shipment to South Africa.

THE AUTOMOBILE IN WARFARE.

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THE BOOKLOVERS LIBRARY

A Two-Minute Talk

The shares of THE BOOKLOVERS LIBRARY *Corporation* have had an unparalleled record. The stock is held in the United States, Canada and England by widely known literary, professional and business people. Among the library's shareholders are hundreds of names familiar to almost every cultured home. No broker, or banker, or underwriter has had a hand in the sales. The sole backing of the concern has been its enterprise, its continuous push, and its far-seeing business policy. Every dollar invested shows a hundred cents' worth of extended and established earning capacity.

The plans outlined from time to time have been carried forward in the most aggressive sort of way. We have done what we said we would do. We planned to extend the *Booklovers* to every important city of the United States; the libraries are there. We promised to include Canada; the two successful centers of Montreal and Toronto are the result; from these cities the service extends to outlying Canadian cities and towns. We made arrangements for extending the work to England; today the *Booklovers* is the talk of London; it is delivering books throughout Great Britain, and includes among its patrons scores of the most distinguished families. We promised an auxiliary library to take care of the field not occupied by the *Booklovers;* the *Tabard Inn* with its revolving book-cases and five-cent exchanges is extending the library privileges to thousands of country towns; the earnings of this one department at the present time exceed one thousand dollars a day with only one-twentieth of the field covered. This new library department was started only a year ago. In another year it will have earning capacity largely in excess even of the *Booklovers.* Last fall we announced the preparation of a monthly magazine to round out our publicity plans; today *The Booklovers Magazine* sells out its complete edition by the fifteenth of each month; it is owned independently by shareholders of the parent company, and presents all the elements of an excellent property.

We are building into the future; the whole book and publishing trade is undergoing rapid and far-reaching changes; there is a new book published in the United States every hour, day and night, and this enormous output must have its distributing machinery. Millions invested in central storehouses of granite or marble can never change the popular current. The American people want an up-to-date service in books as well as in newspapers, and they are willing to pay for it with their own cash. There is no denying the fact that the *Booklovers* is already a tremendous power among the book interests of the country; it has battled its way to the front, where it means to stay.

In connection with this public offer of a comparatively small block of *Booklovers* stock there are four inside facts which I want to make public over my own signature: 1. The *Booklovers* earnings during the three months ending February 28 were **the largest in the history of the enterprise:** 2. The operating expenses per library member were never smaller than at the present time: 3. The "used books" are wholly taken care of at good prices by auxiliary library departments: 4. The Corporation pays cash, and has no debts other than its current monthly accounts.

No additional capital is needed for the *Booklovers;* the increased capital is being used at the present time to extend the *Tabard Inn* and other departments; these auxiliary libraries are necessary to round out the best interests of the enterprise at large; they are the "by-products" of the business and they offer opportunity for very large profits.

The Corporation is capitalized for **$2,600,000** (260,000 Shares at $10 each). Of this amount **190,000 Shares** have already been subscribed and paid for at the par value of $10, making the present cash capital **$1,900,000.** There remain in the Treasury only **70,000 Shares.** Of this remaining block the Directors have authorized the Treasurer to set aside 50,000 Shares to be offered for sale on May 15th next, at $12 a Share. The remainder, consisting of **20,000 Shares,** is now offered to the public in lots of Ten Shares or more at **$10 a Share.** The terms are 10 per cent. with the application and the balance in sixty days. Stock applied for by telegraph will be held five days to await deposit and formal application. (See application form below.) The sale of this block of 20,000 Shares now at $10 and of the remaining block of 50,000 Shares on May 15th at $12 will give the Company **a completely paid-up Capital.** This announcement gives investors the last opportunity they will have of buying *Booklovers* at $10 a Share.

The **Booklovers Corporation** has paid dividends at the rate of **10 per cent.** per year since August 1, 1900. The last half-yearly dividend was paid on February 20th. The half-yearly dividend periods end June 30th and December 31st, respectively. The Corporation has no bonded debts, and its stock when fully paid is non-assessable. All Shares become dividend-bearing from the date of final payment. Dividends are payable in February and August. Applications for stock should be made out in the form prescribed below and addressed to the Treasurer.

President

1323 Walnut Street, PHILADELPHIA

Application Form for Booklovers Stock

(Use wording below in writing out your application)

(*Date*)

MR. JOHN E. BRYANT, Treasurer
1323 Walnut Street, PHILADELPHIA

Dear Sir:

Please enter my name for.....Shares of the Stock of The Booklovers Library at Ten Dollars a Share. I enclose my check for $.....being Ten Per Cent. of the par value, and I agree to pay the balance in sixty days.

Name.....

Address.....

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"Tacked on to one of the big guns they should, weather permitting, shift them rapidly from place to place; nor are they quite helpless when the ground has been soaked with rain. Clip-irons are attached to the rims of the broad wheels, and these dig into the firmer soil, and the steamer rolls forward, leaving a wake like a plowed field. On the flat dry veldt the steamers trip along at a brisk eight miles an hour."

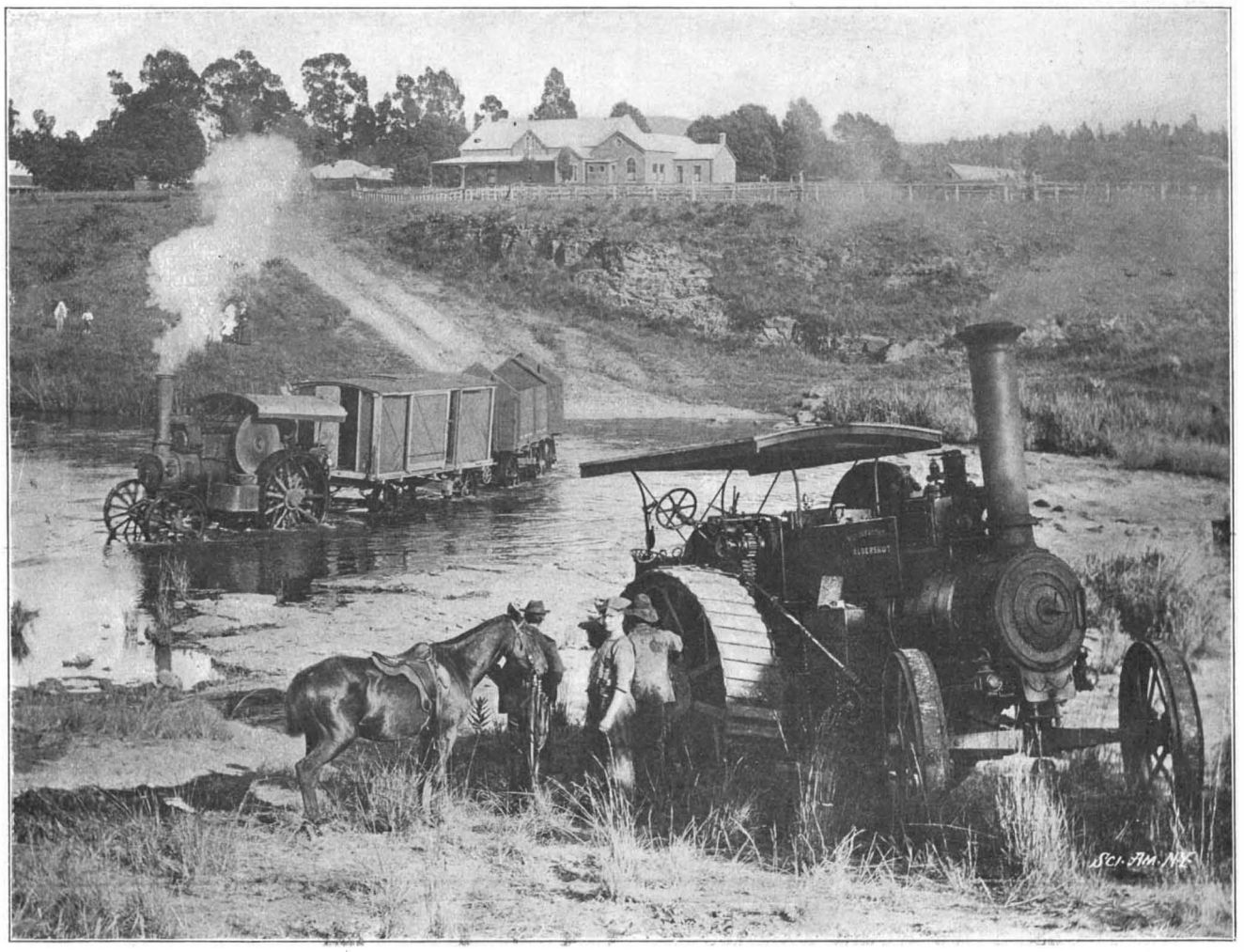
Writing later (on January 15) from Potgieter's Drift, Mr. Burleigh has another good word for the steam sappers.

Describing the crossing of Blaauwkran's Drift by Sir Charles Warren's Division, he says:

"It was a prolonged and desperate scramble to get the men and about 400 wagons and nondescript vehicles down the steep, slippery bank, through the waist-deep stream and up the sticky opposite slopes. Three ox-wagons were run down into the river and converted into bridge piers, planks being laid whereon part of the infantry were able to pass over dry shod, but the planks and footing were insecure in places, and it came to be like walking the greasy pole at Ramsgate Aquatic Sports, for numbers of Tommies went hurriedly into the water in the most diverse and eccentric manner, to the surprise of lots of people. The much-laughed-at score of Aldershot traction engines did not stick and flounder in the mud, but lumbered about, doing duty with comparative ease and considerable regularity. Their flanged grips upon the wheels gave them a sure bite of the ground, which in one or two places they churned up rather deeply.

"A by no means overloaded ox-wagon stuck in the middle of Blaauwkran's Drift close to Frere Station. Eighty oxen were tried, and were unable to move the wagon an inch. It seemed as if the whole column must wait until the vehicle was carted off. A traction engine was requisitioned to try its powers; the enormous span of cattle were taken away, and a steel hawser was passed from the engine and made fast to the disselloom. Then steam was turned on, and with snort and a hiss the steamer walked away with the wagon, conveying it some distance to a high, dry part of the roadway."

The military ox-wagon travels at a maximum speed of three miles an hour and 15 miles a day. The traction engine, while capable of hauling from 30 to 40 tons, will travel with ease 35 miles in the course of the day.



Engines Crossing a South African River.

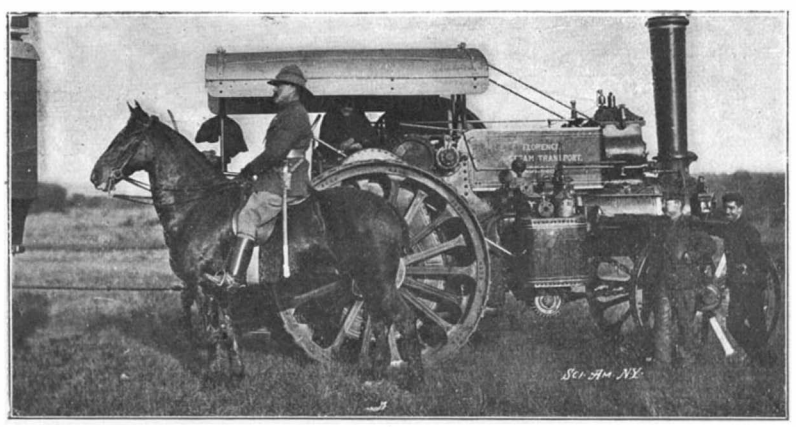
Mention may here be made of the armored road train, specially manufactured for the War Office by Messrs. John Fowler & Co., of Leeds. The engine of this train was completely armor-plated with half-inch nickel-steel plates, and the trucks designed to carry howitzers or 4.7-inch guns were also armor-plated with armor guaranteed to be Mauser bullet-proof at 100 yards. Probably all military traction engines will in the future be armor-plated.

When Col. Crompton, who commanded the corps, was organizing his equipment, he realized that it must be entirely independent of railways, and that motors must therefore be employed. Having had a good deal of experience with the steam horse while in India, he was able to design some traction engines especially suited for a campaign in South Africa. They weighed only eight tons, and consumed about 28 pounds of water an hour for every electrical horse power developed. Whenever Lord Roberts wanted to put the 6-inch guns into a position which was difficult, he always sent for the traction engines. One of Crompton's tasks was the management of a line of steam traction between Pretoria and Rustenburg. In the course of a week it would take about 130 tons of food for two columns 20 or 30 miles west of Pretoria. Thirty tons of this amount were food for men, and 100 tons were for horses and mules; and if the columns had been supplied with self-propelled vehicles, the weight could have been cut down to about seven or eight tons of fuel in place of the 100 tons of forage.

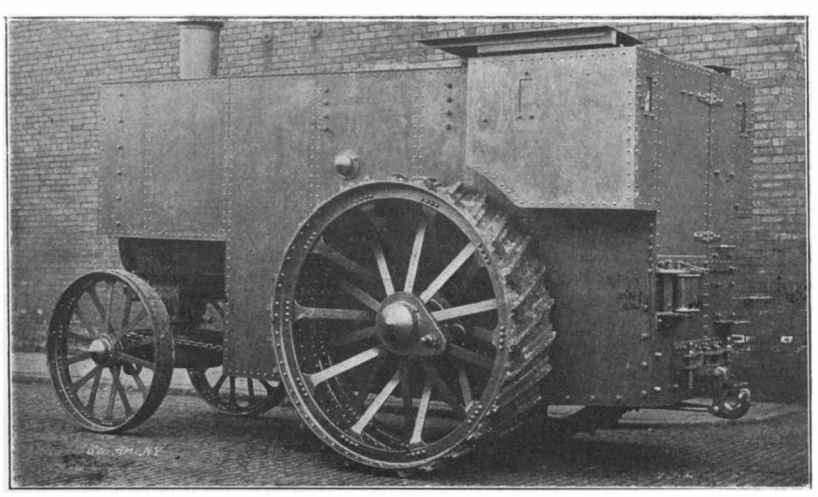
Col. Crompton says:

"On the 24th of July, a 6-inch quick-firing gun, weighing with its carriage 12½ tons, was hauled to the top of Quagga Kop, seven miles to the west of Pretoria, and 1,300 feet above it; the average slope up which the gun was hauled was 1 in 10, but there were parts of it which were steeper.

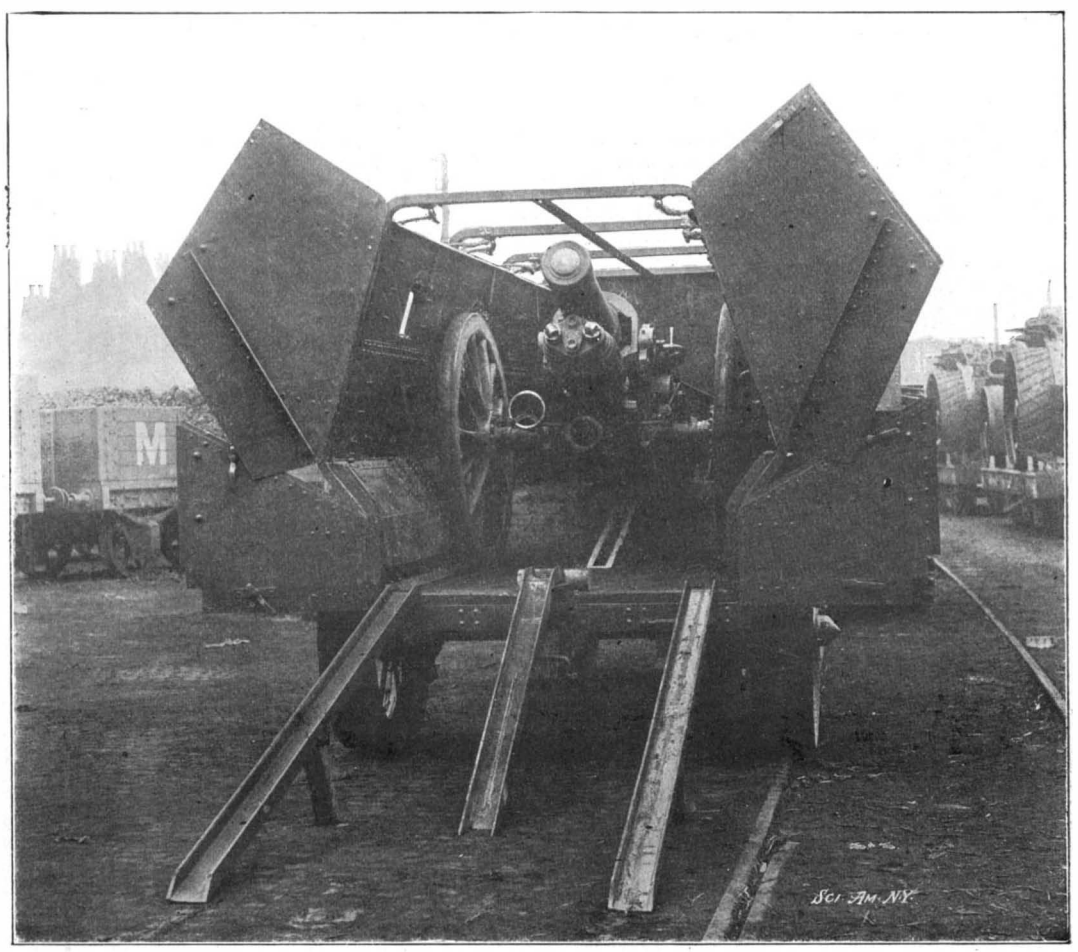
"On the 1st of August a similar gun was hauled up a slope averaging 1 in 6, and in some places more than 1 in 5, to a redoubt on the top of this hill, about five miles east of the town. A few days later two large traction engines belonging to the director of steam transport were also put under our charge, under the officers of the Electrical Engineers, and with these and the other three engines, making five traction engines, a regular daily service was organized, and stores of every character were transported to various points, chiefly to the westward of Pretoria, the longest run being to Commando Nek, 26 miles



Col. Templer at the Cape Inspecting the Engines Sent from England.



Fowler Traction Engine Sent to South Africa.



Howitzer in an Armored Wagon.

THE AUTOMOBILE IN WARFARE.

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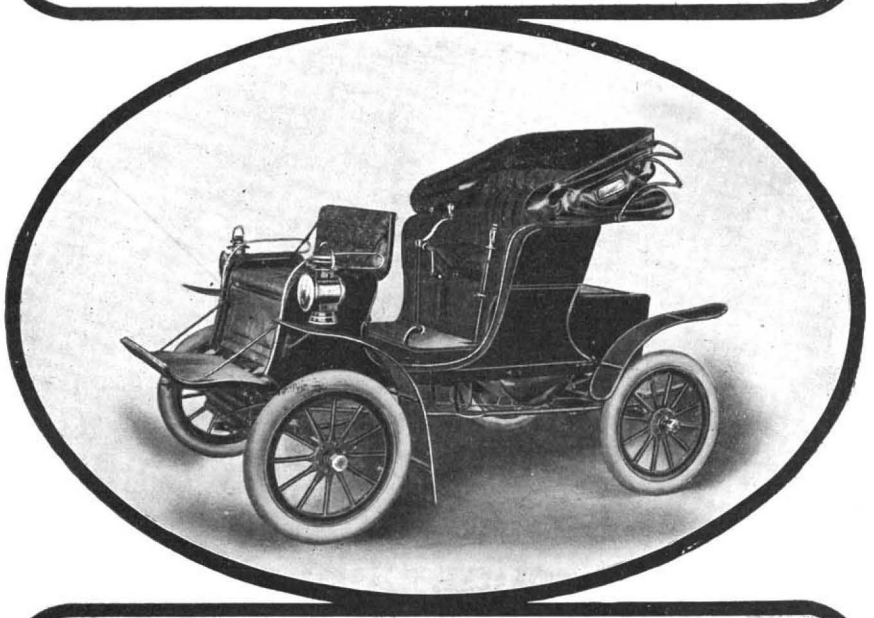
STEVENS-DURYEA



Our car has established a record **second to none,** and all intending purchasers should look into its merits before placing their order. We have demonstrated that for

Speed, Reliability, Hill-climbing

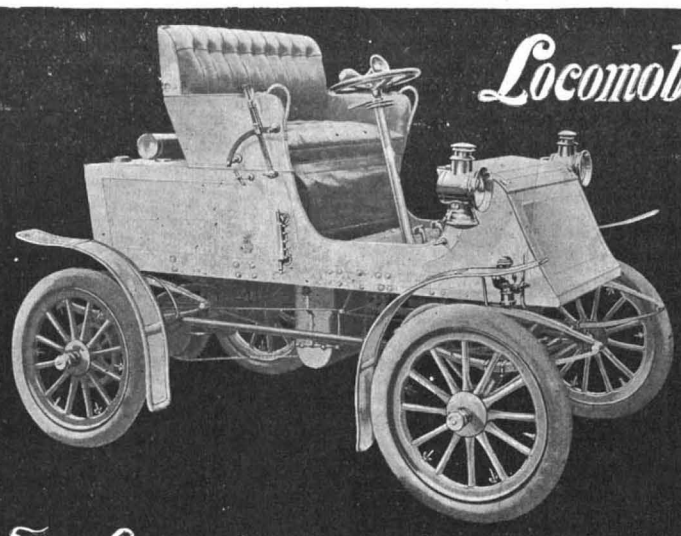
it has no **superior** in its class. It is equipped with a powerful seven-horse two-cylinder opposed motor of the four-cycle type, and has three speeds and reverse, all operated by the same lever. It also....

STARTS FROM THE SEAT

Price at factory, including Full Equipment ... **$1,300.00**

J. STEVENS ARMS & TOOL COMPANY
No. 925 Main Street
CHICOPEE FALLS MASSACHUSETTS

Locomobile



The Locomobile is the best automobile

Above is shown the 1903 Stanhope "B" (Steam), a desirable touring car.

IMPROVEMENTS:

Enlarged Boiler. Indestructible Water Gauge. 10 H. P. Engine, encased and using superheated steam. Four Band Brakes. Victor Steam Pumps.

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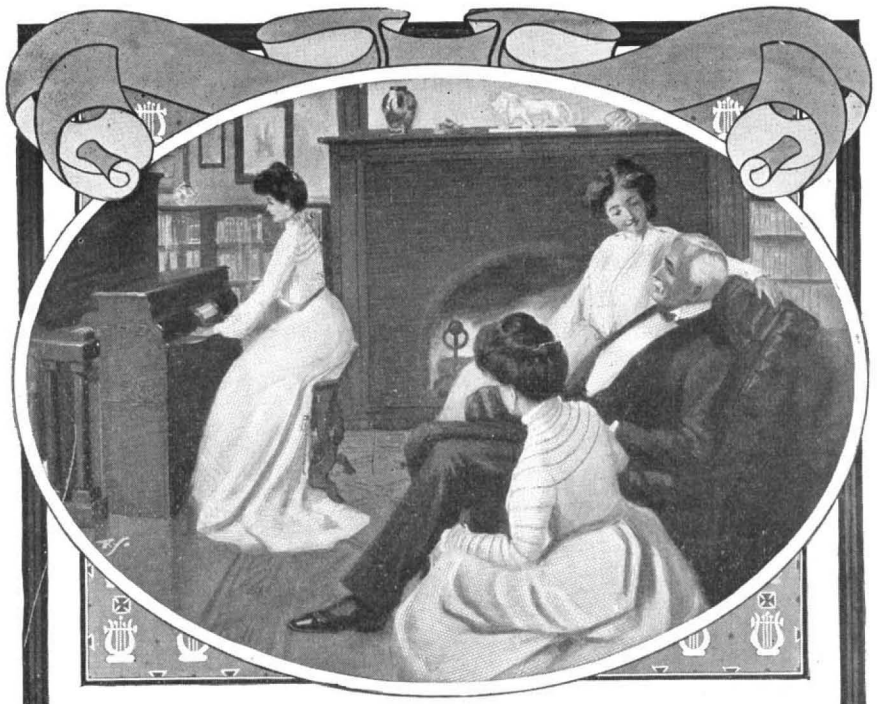

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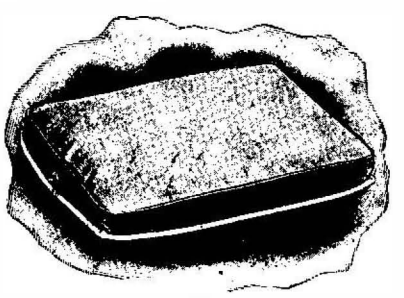

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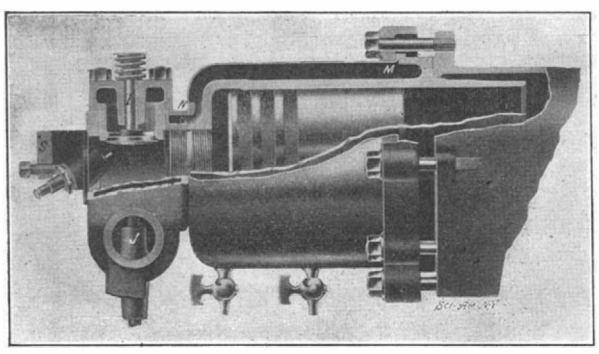
distant, where a depot was formed for flying columns. The service on this road lasted for many weeks, in fact, up to the time the corps started for England, and was carried out without any mishap or loss, although during the whole of the time the line was threatened by the Boers, and sniping frequently went on, but no one of the corps was hit. A new system of escorts was adopted; sufficient men to form two or more escorts being put under the command of the officers of the corps and encamped with the corps. The engines did twice whatever the Boers did, and twice whatever the English sailors did."

The lesson of the war as regarded automobilism was a very striking one. It was this—the whole of the Transvaal was one mass of dead animals. It was impossible to feed them. They died by hundreds of starvation. The great outbreak of enteric fever was no doubt caused by the mass of dead and dying animals. But there was not a dead or stinking traction engine in the whole of South Africa. While managing a line of steam traction from Pretoria to Rustenburg, Col. Crompton took about 130 tons of food per week for two columns 20 or 30 miles west of Pretoria. Thirty tons of that amount was food for men and 100 tons was for horses and mules. Had it been possible to supply self-propelled vehicles to the columns, the weight could have been cut to about seven or eight tons of fuel in place of the 100 tons of forage. All the heavier things, such as guns, wagons, engineers' park, etc., have been and can be transported most successfully by self-propelled machines, either steam or oil. There is a much more difficult question, and that is to do something to relieve the English cavalryman and mounted infantryman of the huge weight the horses have to carry. Col. Crompton wishes to introduce into the service some light vehicle that could accompany the cavalry and mounted infantry, and carry part of the weight which killed the horses and destroyed the mobility of the British army. He sees no difficulty in producing a 25-hundredweight engine to carry its two tons of load, to follow the mounted troops in all places where wheeled carriages could go. As an instance of what traction engines had done in South Africa, Col. Crompton stated that he had seen engines take a 10-ton gun up a gradient of 1 in 5.

THE CADILLAC GASOLINE RUNABOUT.

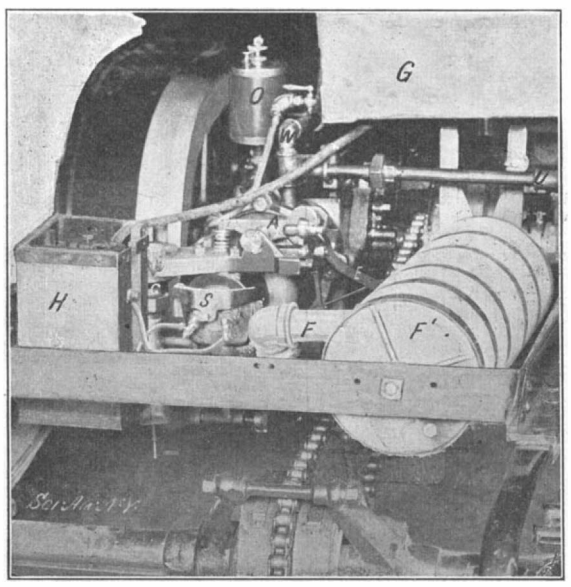
The gasoline machine illustrated on this page is a moderate-priced car recently placed on the market,



CYLINDER OF MOTOR, SHOWING METHOD OF CLAMPING ON COPPER WATER JACKET.

and having a number of original features worthy of description. All parts are made interchangeable as far as possible, and the body is entirely separate from the chassis, from which it can be quickly removed by withdrawing six bolts.

The chassis is planned after the standard pattern of American runabout. A 5 x 5-inch horizontal motor is mounted on an angle-iron frame and is connected to the rear axle by a chain. The planetary gears for the slow speed and reverse, as well as the fast speed clutch, are carried on the motor shaft outside of the



MECHANISM OF CAR VIEWED FROM THE REAR.

driving sprocket, and this shaft is made sufficiently heavy so that a third bearing on the end beyond the gears is not required. The slow-speed and reverse gears are thrown in by the usual band brakes, while the fast speed clutch of the friction disk type is operated by a long lever seen at the side of the seat.

The motor crank case and cylinder are two separate castings, bolted together as shown. A copper water jacket is clamped in place between the clamping ring and flange, *M*, on the cylinder, and flanges, *N*, on the cylinder end and the valve chamber, which is screwed tightly against the end of the cylinder on a large steel pipe nipple. The two pet cocks shown connect with the cylinder and water jacket respectively. The inlet and exhaust valves, *I* and *J*, can be seen in the valve chamber in the sectional view of the motor, as well as the method of clamping the water jacket in place. The clamp, *S*, holds in place a plate carrying two mica spark plugs. The spark jumps from one to the other, and as both are insulated, the chances of short-circuiting are small. The inlet valve is operated mechanically, and the amount it opens is controlled by an eccentric-operated rod, *E*, curved at its end to pass between a roller on the end of the valve-opening arm, *A*, and a movable roller beneath it. The end of *E* is tapered on its lower side, which slides on the movable roller, and by sliding this roller forward so as to make more of the tapered part of *E* ride upon it, the upper surface of *E* and the roller arm *A* are raised higher, thus opening the valve wider. A handle on the steering wheel controls the movement of the lower roller and hence the opening of the valve. The motor is controlled almost entirely by this ingenious throttle arrangement.

The carbureter, seen at *C*, is of the float feed, atomizer type. The needle valve button for setting the mixture projects from the carbureter top. A wire gauze cone on a suction-lifted valve that fits in the spraying nozzle, breaks up the gasoline and tends to vaporize it. Wire gauze is also placed in the opening of the air-suction pipe below the carbureter. The spark coil is located in a box, *H*, behind the carbureter. Its two secondary wires can be seen connected to the two spark plugs, as well as a heavy primary wire extending to the circuit breaker on the motor. *O* is the cylinder oil-cup; *G* the gasoline tank; and *F* the exhaust pipe leading into the muffler, *F'*.

The water is circulated through the cooling coils by a centrifugal pump. It passes from the water jacket of the motor through pipe, *U*, while pipe, *W*, connecting with the water tank, conveys water to the system to replace any that evaporates. The water in the tank is always kept cool and forms no part of the circulatory system, being used merely as an extra supply.

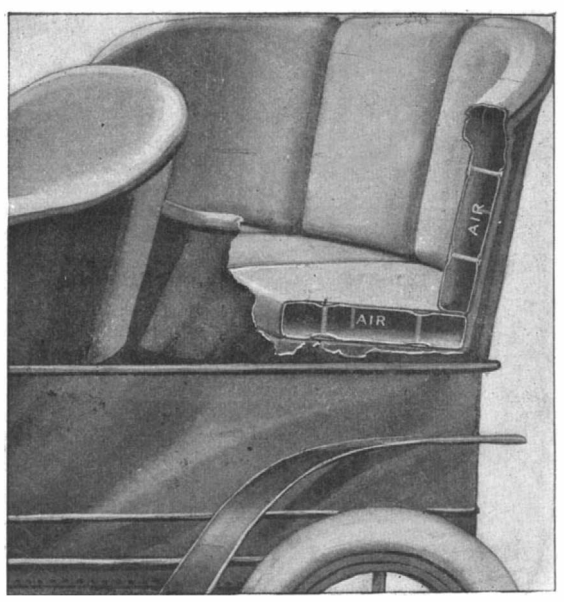
The crank shaft boxes of the motor can be slipped out and new ones put in without taking the whole engine apart. This can be accomplished very simply by removing four nuts and taking two caps off the crank case, thus enabling one to get at the boxes, which are each in two halves. The crank shaft is a one-piece forging, much larger and more substantial than is ordinarily used with the size motor employed.

The car is strongly built throughout. Ball bearings are used on the front wheels and rear axle, and the latter is strongly braced about the differential.

The tonneau body can be easily attached and fastened in place by two bolts, thus increasing the carrying capacity of the machine to four people, at a moment's notice.

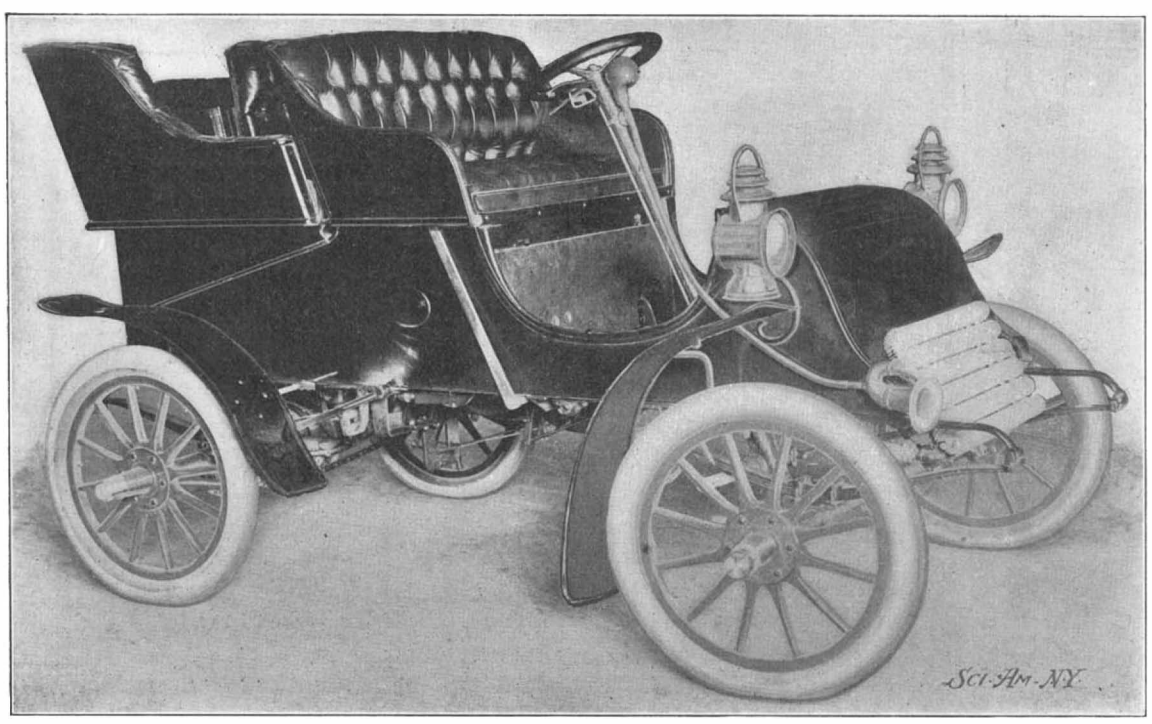
AUTOMOBILE AIR CUSHIONS.

Air cushions are now manufactured which are calculated to add as much to the comfort of the individual as pneumatic tires have to the smooth running of the machine. The cushions shown in the illustration are made of cotton duck coated with rubber sufficiently thick to make the fabric air-tight. Stays are placed on the inside at regular intervals for the purpose of holding the cushion in proper shape when inflated. The cushions have outer coverings of cordu-

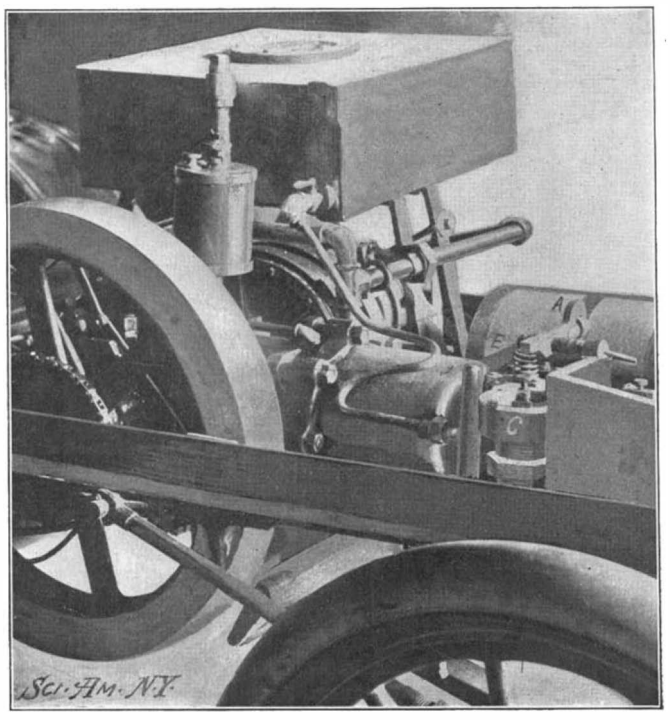


AIR CUSHION FOR AUTOMOBILES.

roy, leather, duck, etc., according to fancy. Their backs, sides, and seats are smooth and have no ridges or buttons to render them uncomfortable. Having no hollows, they do not hold the dust, and being made of rubber, are proof against dampness.



A 6 H. P. CADILLAC RUNABOUT.



ENGINE AND MECHANISM OF CADILLAC CAR.

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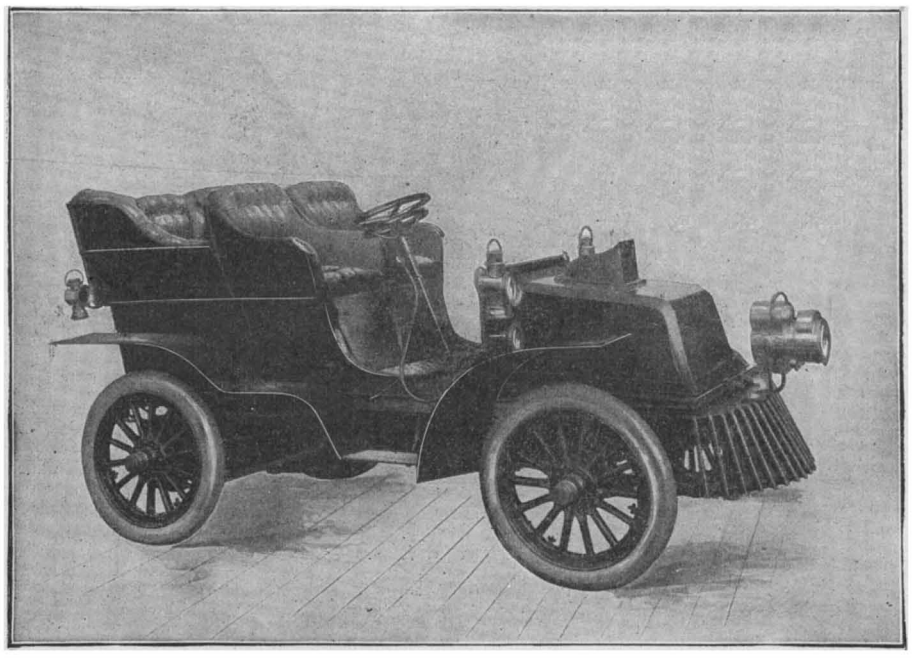

Grand Tonneau

Records....

500-mile Run, New York to Boston and Return, Three First-class Certificates and Gold Medal, First Prize

England, Dashwood Hill, a 6½ H. P. Grout beat every car on the hill with a rear tire badly punctured

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Boiler in front, engine horizontal, side drive, wheel throttle, down draft, a hill climber and very speedy

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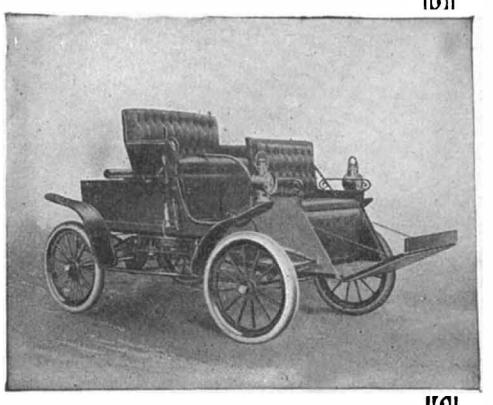

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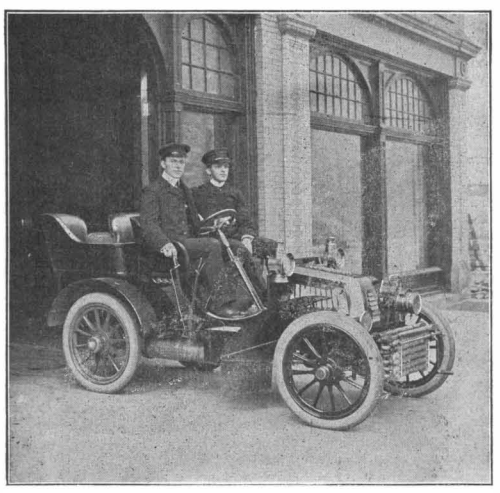

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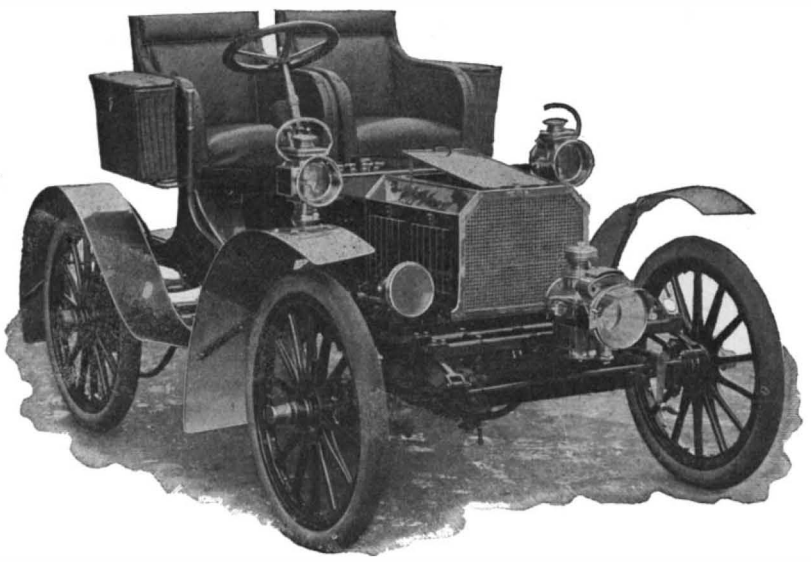

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Tonneau, 9 " " 1,000 " " 1,500

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A NOVEL SNOW LOCOMOTIVE.

The accompanying illustrations show the general appearance and details of a 200 horse power snow locomotive invented by Mr. George Glover, of Chicago, Ill., and used with success by Gen. R. A. Alger for hauling logs in his Michigan pineries.

The mechanism is plainly to be seen in one illustration, the boiler being situated at the rear end of the frame and the engine at the forward end, while the driving drum, heated by the exhaust for melting the snow, and thus at the same time acting as a condenser, is located in the middle.

The engine has two horizontal cylinders, and is placed between two long steel beams forming the stringers of the frame. All that can be seen of it is the steam chests, rock bar, reverse lever, end of the crank shaft, etc. The two steam pipes, rising from the steam chests, unite below the throttle valve, and the single pipe formed, reaching to a sufficient height to pass over the water tank, runs back to the boiler, where it enters the top of the dome. The exhaust pipe runs to the driving axle of the traction wheel, or drum, to carry steam into the drum to keep it hot. It also rises, like the live steam pipe, sufficiently high to pass over the water tank and enter the smoke stack on top of the boiler.

The exhaust pipe is equipped with valves, so that the entire steam may be exhausted into the driving drum, or all may be exhausted into the smoke stack, or a part into each, and a part into the atmosphere, through the pipe passing through the roof. This gives the engineer complete control of the exhaust and its distribution.

Next comes the water tank, supported on a steel frame at each end, and bound down by guy rods which pass over it. Its capacity is about 1,000 gallons. The water, however, is carried to a great extent in the driving drum and then forced back into the water tank, to be again fed to the boiler. A 6 x 4 x 6 duplex feed-water pump is used for this purpose. This is situated on the other side of the boiler from that seen in our illustration, and the horizontal pipe seen in front of the driving drum connects the water tank with it. The pump has a capacity of 100 gallons per minute, and is used for filling the tank with water drawn through a 2½-inch hose from a brook or other available source.

The driving drum is shown in the photograph in a false position for convenience in loading and unloading the locomotive for transportation by rail. The working position of the drum and its frame is shown in dotted lines. A 12-tooth steel pinion on the crank shaft drives the 48-tooth gear on the hinge-pin shaft, which is 5 inches in diameter and forms the hinge of the driving drum's frame, thus permitting the drum to follow the inequalities of the road. On this shaft a pair of 14-tooth pinions drive 44-tooth intermediate gears, which transmit the power to 68-tooth gears on each end of the traction wheel or drum.

The steam nigger (the cylinder seen at the left of the boiler), is used to throw the weight of nearly the entire machinery and frame on the traction drum when bad roads or snow drifts are encountered, and also, when going up hill with a heavy train. The handle of the rod controlling the three-way valve, which operates the nigger, is immediately above the head of the engineer, where he can reach it instantly, and, by depressing the piston which is directly connected to the drum frame, throw any amount of weight up to 12 tons additional onto the driving drum. As shown in the illustration, this handle is at the end of the rod extending from the three-way valve, which is at the top of the cylinder or nigger.

The steering apparatus is operated by hydraulic power.

The locomotive runs as readily one way as another, the pilot or steersman simply going to the other end, so that he is at the front end of the machine no matter in which direction it is going. He transmits signals to the engineer by means of a small steam whistle beside the latter. A third man—a fireman—is required to keep up steam.

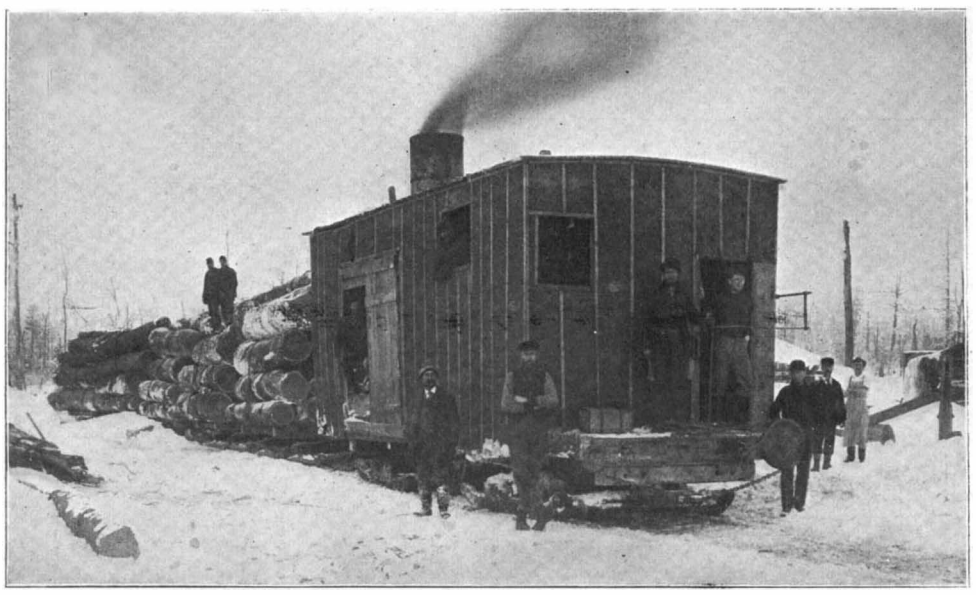
The boiler, which is of the vertical type, 72 inches in diameter by 8 feet high, has a heating surface of 700 square feet. A specially constructed and attached dome is placed on top of the boiler, having five connections, and taking steam at five different points on top of it. This prevents drawing water, and also permits carrying the water very high, besides superheating the steam, as the dome is really in the hottest part of the fire, being encased in the smoke stack as shown. The dimensions of the dome are 20 inches by 30 inches. The bob sleds go under the oak bolster, which is under the boiler at the hind end and under the engine at the front end. A foot of snow is not much of an impediment to the machine, and it will travel through two and a half feet at about a walking gate. After having been over the road a few times, it has a road-bed of packed ice, and then a speed up to 12 miles an hour may be used with safety, as the runners are running in ice grooves and will almost keep the track themselves, without the steersman's attention.

There are two speeds operated by clutches, and obtained by a small pinion at one end of the engine shaft and a larger one at the other end.

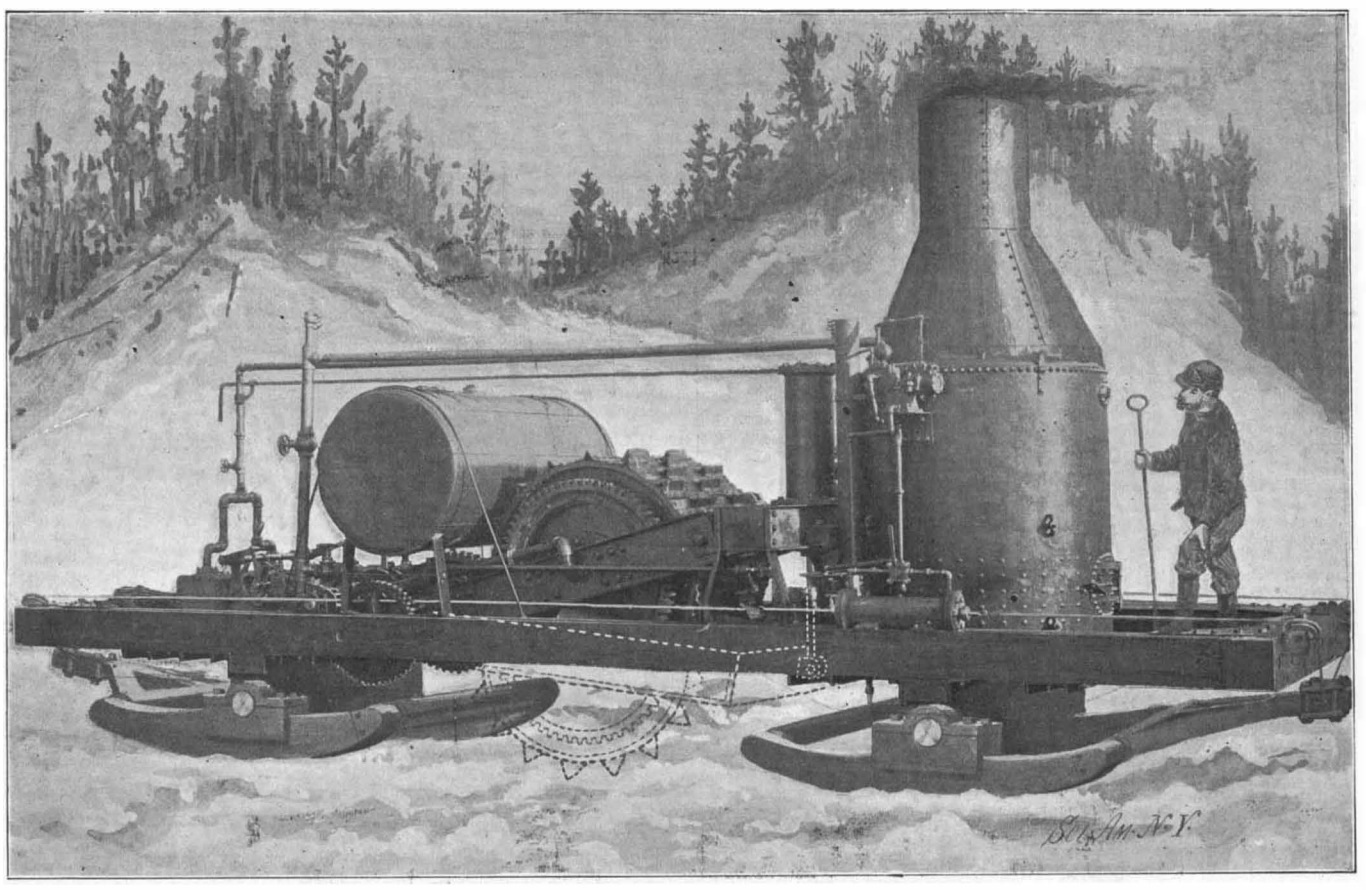
The locomotive weighs 30 tons, yet it is capable of hauling the three sleds shown, with a total load on them of 100 tons. But 18 pounds of steam is required to operate the locomotive on a well-beaten track; and, as the working pressure is 160 pounds, there is great reserve power for emergencies and adverse conditions. Experiments have shown that, on a smooth ice track, the locomotive can haul a 150-ton train at 6 miles an hour.

The development of the automobile boiler has made it possible for these machines to be built at least 8 tons lighter than formerly, as a battery of three or four small boilers, which will be nearly six tons lighter, and yet will carry 300 pounds of steam or more, will make an engine of less than half the weight give sufficient power, while allowing of a lighter construction of the frame which carries this monstrous weight. The lighter weight will also enable a machine to work on ground that is no harder than necessary for a heavy team to travel over, as well as to haul loads across lakes on the ice, where it will be of great advantage. The development of the four-cylinder hydro-carbon engine will also reduce the weight question in this machine.

The driving wheel for automobiles for freighting or passenger purposes is a modification of the Glover snow traction drum. The face of the wheel is semi-toothed or semi-cupped for traveling through sand or soft roads, and has a solid rubber tire on each outer edge, which acts as a flange to hold the sand from squeezing out under the wheel. On pavement or good roads, these tires do the driving, and the semi-cup-shaped face of the wheel between the solid tires does not come within an inch or so of the ground or pavement. The Glover driving wheel, as applied to the automobile, is said to save a great waste of power, especially on bad roads and up hills, while it does away with the compensating gears on the hind axle, thus permitting of the use of a solid axle. The rear wheels run loose on their axles, the same as the front wheels, and the fifth, or traction wheel, is placed in the center of the machine directly under the body.



SNOW LOCOMOTIVE HAULING A LOGGING TRAIN IN GEN. ALGER'S PINERIES.



SNOW LOCOMOTIVE WITH HOUSING REMOVED TO SHOW THE OPERATIVE MECHANISM.

Manufacture of Quartz Glass in Germany.

Under the heading "A New German Industry," German papers state that the manufacture of quartz glass is rapidly developing.

Quartz glass consists essentially of melted quartz, which is made into tubes and other articles. It is perfectly translucent. The initial experiments in the manufacture of the new glass were made in England, but a firm at Hanau, a few miles from Frankfort, was the first to place quartz glass apparatus upon the market.

The manufacture of quartz glass is yet in its infancy, but has already shown symptoms of vigorous growth. While two years ago England led in its production, she has since been relegated to second place by Germany. Everybody who knows the properties of quartz glass admits that it will soon replace ordinary glass for many uses. It is only a comparatively short time since German manufacturers revolutionized the manufacture of optical glasses and obtained a monopoly of this important industry, and there is reason to believe that this will be repeated with quartz glass.

If quartz glass can be produced at a moderate price—and this seems to be quite possible where electric force can be cheaply obtained from water power—it will no doubt be largely employed.

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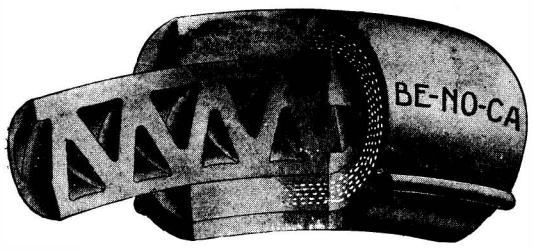

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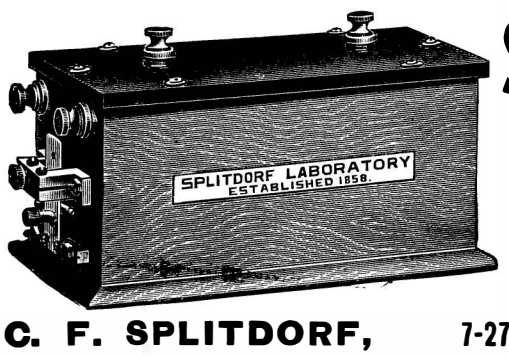

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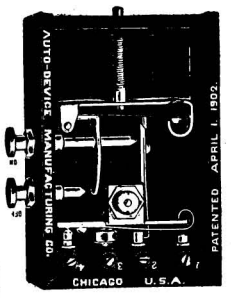

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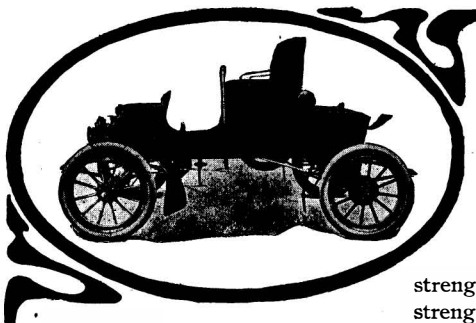

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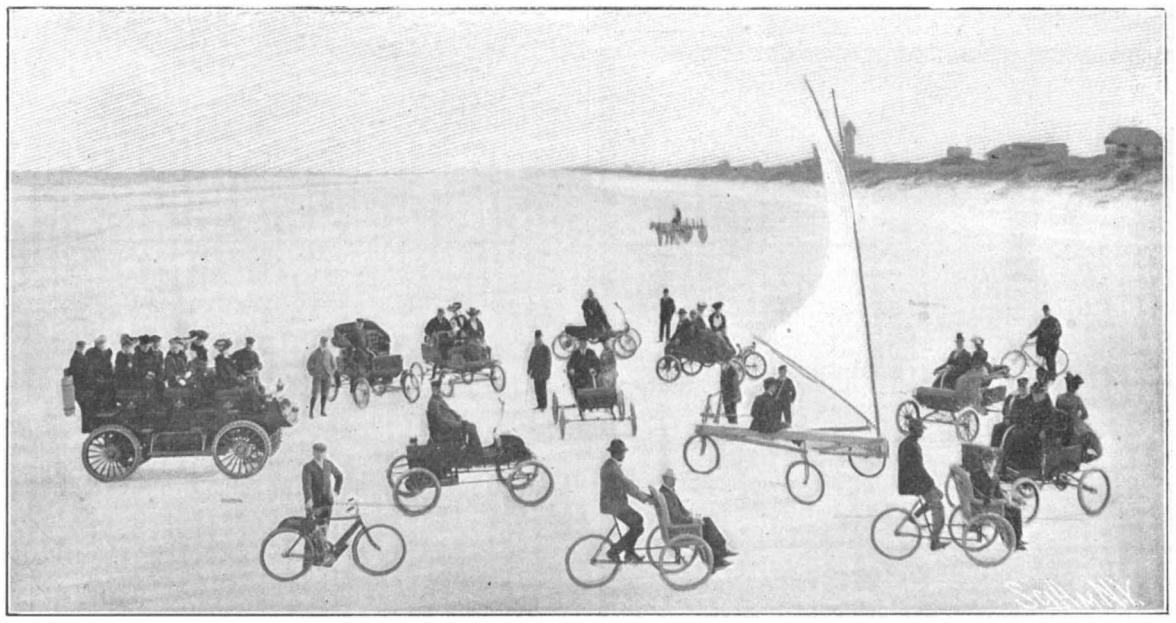
A NEW SPORT.

BY DAY ALLEN WILLEY.

The eastern coast of Florida between Daytona and Ormonde includes a stretch of sand which is about thirty miles in length and remarkable for its smooth and hard surface. It is so firm that it is utilized as a boulevard by horse vehicles of various kinds and by automobiles, bicycles, and what are locally termed "sand-sailers." During the winter season, when the resorts mentioned are largely patronized, nearly every variety of vehicle operated by steam or gasoline can be seen upon the beach. The photographs show a collection of the various automobiles which have been used here during the past winter. They include not only a break, but runabouts of various kinds. In the picture are no less than seven different kinds of autos, including the motor bicycle.

The "sand-sailers" consist of a framework spread on three bicycle wheels, to which is attached an ordinary sprit-sail. The rear wheel is used to steer the "craft," and it can be operated quite close to the wind, while in running before the wind it frequently attains a very high speed. Some of the bicyclists who use the beach for a course have fitted up sails which are fastened to a mast attached to the framework, and are used in coasting before the wind.



VARIOUS TYPES OF SELF-PROPELLED VEHICLES USED ON THE BEACHES OF FLORIDA.

THE AUTOMOBILE AND ITS HORSE POWER: A READY METHOD OF DETERMINING THE LATTER EXPERIMENTALLY.

BY PROF. N. MONROE HOPKINS, PH.D.

The term "horse power," although in the most general use, and, since the development of the automobile, almost a household term, is not generally understood or correctly interpreted by the average layman. In these days of rapid motor vehicle development on every side, it would appear that a true conception of this important and historic engineering unit should be fully grasped, especially by those owning and operating the various classes of machines.

In order to properly appreciate the capabilities of a motor car when its horse power is given, and to clearly introduce the method of the writer for experimentally determining the horse power of any kind of motor-driven vehicle, a complete understanding of the simple mechanics of this unit should first be had. The method is in accordance with well-known engineering practice, but is so simplified that it may be understood and applied by the non-technical reader. Horse power was originally based upon the assumption that a horse performs a certain definite amount of work in a given time. This old view, if one stops to reflect for a moment, is clearly incorrect, for there are horses and horses, and even with the same animal, changing conditions of energy and usefulness exist, depending upon many factors, so our unit would be of a shifting nature, and for exact work totally valueless. We must, therefore, if something of constant value is essential, adopt some scientific standard, making this standard equal to the work which may be done by an average horse if we wish. It is of little consequence what we make our standard equal to, so long as it is of convenient size, and is above all unchangeable.

The "foot-pound-minute" has been chosen as the basis in America and England for determinations of mechanical power, and the power to do work of a horse has been repeatedly measured by actual experiments in these terms. There is nothing abstruse about the foot-pound-minute. It simply means the work done in raising a weight of one pound one foot high against gravity in one minute, and consequently involves the factors of mass, space, and time. A foot-pound-minute may be expressed in several ways as follows: One pound raised one foot high in one minute; one-half pound raised two feet high in one minute; or two pounds raised one foot high in two minutes. It matters not which way we legitimately adjust these conditions, the power required in each case is the same. One hundred foot-pounds, therefore, may be expressed as one hundred pounds raised one foot high in one minute, or one pound raised one hundred feet high in one minute, or one pound raised one foot high in one one-hundredth of a minute. In each of these three cases one hundred foot-pounds of work has been done.

Now, having these units, it remains to see just what weight a horse can raise through a given height in a given time, and it will be noted what a vast difference exists in horses of different types.

Boulton and Watt performed experiments with the strongest dray horses in London, and found that such animals could, when hauling at their utmost under the application of the whip, advance at the rate of 220 feet per minute when attached by their collars to a rope running over a wheel lifting a weight of 150 pounds. Here we have 150 pounds lifted through a vertical distance of 220 feet per minute, which is equivalent to 33,000 foot-pounds, as is readily seen by multiplying the factors together. As the horse is attached to the weight by a rope which simply has its direction changed by a pulley, the weight of course is lifted through a vertical distance against gravity, which is equal to the horizontal distance traveled by the horse.

Although numerous other determinations were made with different classes of horses, giving of course very varying results, the figure 33,000 as found by Boulton and Watt has been adopted for all mechanical and engineering calculations. As the figures by other experimenters on different kinds of horses vary so, it is thought of interest in this connection to give some of the results. D'Aubuisson determined the work of a different class of horse in terms of foot-pound-minutes by the same method of raising a weight, and obtained 16,440 foot-pounds. Desaguliers' determination gave 44,000 foot-pounds, Smeaton's 22,000, Tredgold's 27,500, and that of the present writer 38,212. It will now be seen how very loosely we would be measuring power to refer to a horse as a unit or standard. The writer has determined the power to do work of a horse on several occasions, by making him draw a loaded wagon up a steep hill, and timing him with a stop watch. In this case it is only necessary to know the weight of the horse and wagon, and the vertical height of the hill. In combination with the time, the weight raised and the altitude of the hill furnish all the data for the computation. The figures of the writer in one case were 38,212, and, in another case, 29,390 foot-pound-minutes. Both of these figures were obtained by making a horse draw a lightly loaded wagon at a high rate of speed, and then a heavily loaded wagon, which of course was carried up at a correspondingly diminished speed. The mean of the two determinations was taken. It is of interest to mention the fact that the lighter of the two horses experimented with gave the highest number of foot-pounds. Similar experiments were also made upon different bicycle riders, weighing the machine and rider, and timing the ascent on a smooth hill with a stop watch in each case. The only important point in the choosing of a hill, next to its smoothness, is, that it shall be steep enough to prevent very fast riding, for in such a case the wind resistance would play an important part and vitiate the determination, making the foot-pound-minutes apparently too low.

The writer has also experimented with nearly every type of automobile, and has determined the horse power developed by various makes, and has in many instances found the power to be rated from ten to fifty per cent higher than it really is. Now, accepting the figure 33,000, which is the American and English standard, and having a smooth, steep hill of known altitude and a stop watch, we are in a position to measure immediately with precision the horse power of any motor vehicle. The altitude of a hill in most towns and cities may be learned from the city or town engineer, or else it may be estimated or measured with a level and rod by the experimenter. By altitude of a hill, the height of the top above the base of course is meant, the length having nothing to do with the matter so long as this is not too great, for if the hill is not steep enough, the automobile will climb so rapidly as to encounter vitiating wind resistances, and then the test would of course be an unfair one.

The machine should be driven at full power and should have no flying start upon a level. It is customary to add about ten per cent to the figure obtained for friction losses, if we wish to determine the inside power of the motor itself. There are other means for measuring the horse power of motors which would be far out of reach of the ordinary automobilist, namely, the dynamometer test and the Prony brake test. In addition to these two general methods, there are a number of special methods, each applicable to the specific type of motor, whether steam, gasoline, or electric. The scheme as given herein is a general one, by far the most simple, and, for steep smooth hills is unrivaled in accuracy.

SAND-SAILING ON A FLORIDA BEACH.

Fatal Termination of the Nice-La Turbie Hill-Climbing Contest.

The annual hill-climbing contest of the Automobile Club of France, which was held April 1, at Nice, was brought to an abrupt end by a fatal accident met with by Count Zborowski. The intrepid chauffeur attempted to round a sharp bend in the road while going 60 miles an hour, without slackening speed, with the result that his machine ran off the road into a cliff, dashing him head first against the rocks and killing him instantly. His companion, Baron Delasague, escaped death almost by a miracle. Mr. Zborowski was a wealthy American automobile enthusiast who raced last year in the Paris-Vienna contest.

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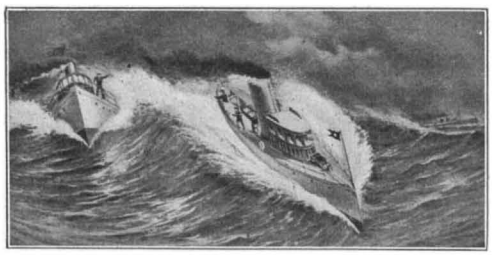

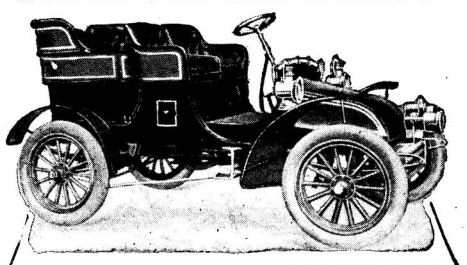

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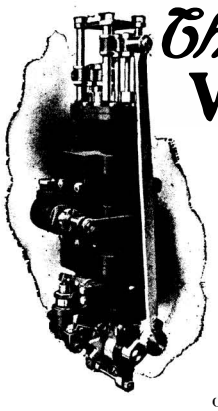

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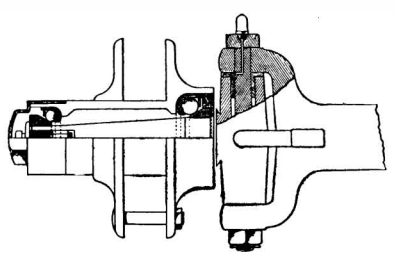

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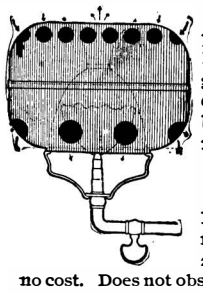

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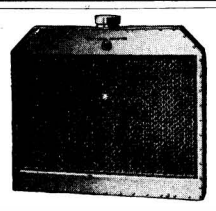

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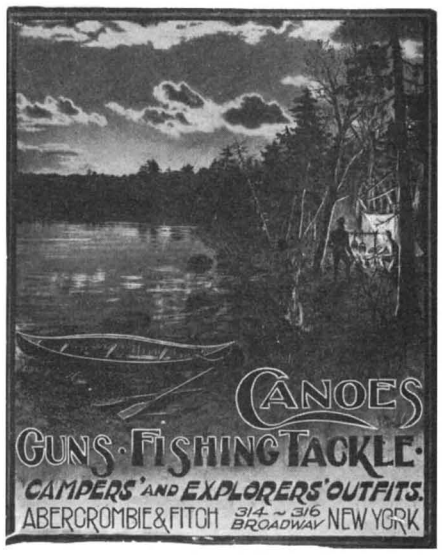

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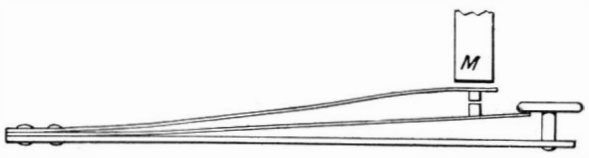
AUTOMOBILE NOVELTIES.

A NEW INTERRUPTER FOR SPARK COILS.

The efficiency of a spark coil depends upon the suddenness with which the contact at the interrupter is broken. The main difficulty with an interrupter of the ordinary spring type is that the break occurs on first movement of the vibrator spring, that is, while the magnetism of the spark coil core is overcoming the inertia of the spring. The movement at this time is comparatively sluggish, and the small spark which



IMPROVED VIBRATOR.

follows the spring for an instant permits a gradual break; for it serves as a path for the current, offering more and more resistance until the spark is finally destroyed by the length of the air gap. A French inventor has produced an improved design of interrupter, which overcomes this objectionable feature by such an arrangement of the parts that the break in the circuit does not occur until the inertia of the spring is overcome. In the construction, the break occurs between the spring and a movable contact piece instead of the usual stationary one. This movable strip is secured to the spring, but is properly insulated therefrom. When, therefore, a current is passed through the coil, the strip travels with the spring toward the magnetized core, *M*, until their inertia is sufficiently overcome and both are moving rapidly, when the contact strip is suddenly checked by a stop. The vibrator spring, however, continues to move quickly forward under the influence of magnetic attraction, and a sharp break in the circuit is made at the contact points. It is claimed that this form of interrupter greatly increases the efficiency of the coil. In a test made by the inventor, a coil which was provided with the usual type of interrupter was barely able to light up a Geissler tube. When the improved interrupter was fitted to the coil, the tube was very brilliantly illuminated.

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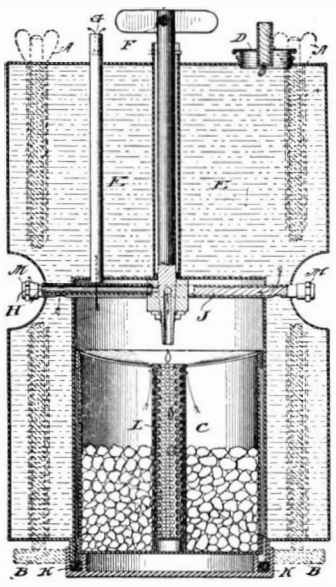
The vibration of automobiles is very harmful to acetylene gas lamps because it tends to accelerate the water feed and produce an excessive generation of gas. A new lamp which is meeting with considerable favor in the automobile world is so arranged that an overcharge of gas acts to choke off the water feed until the gas pressure is restored to normal. This automatic regulation of the gas is obtained in a very novel manner, which may best be explained by reference to the accompanying engraving. The illustration represents a sectional view through the generator. The water is held in reservoir, *E*, which is provided with a gas chamber at the bottom, into which the carbide holder is slipped. The holder is held in place by a cap piece having an annular channel in which is placed the rubber washer, *K*, to effect a gas-tight connection. The carbide holder is provided at its center with a screen-tube, *L*, into which water is dropped. Passing through the water reservoir and gas chamber is a tube, *M*, containing a wick, *J*. This communicates with a reservoir, and conducts the water through the two-way valve, *F*, to the screen tube, *L*. The water here attacks the carbide, and the gas generated passes up through tube, *G*, to the tip. In case of an over-production of gas, since no other escape is provided for it, the gas is forced to pass into the wick, checking the water-feed. Thence it bubbles up through the reservoir and escapes through an opening in cap, *D*. This opening is filled with wool to prevent spilling of the water. When the gas pressure is sufficiently relieved, it is evident that normal conditions will be restored. To extinguish the light, the valve, *F*, is turned, shutting off the water feed and opening a vent, *H*, in the gas chamber. The gas already formed in the chamber will pass out through this vent in preference to the smaller vent at the burner tip. This results in extinguishing the light and, at the same time, prevents the storing of a dangerous charge of gas.



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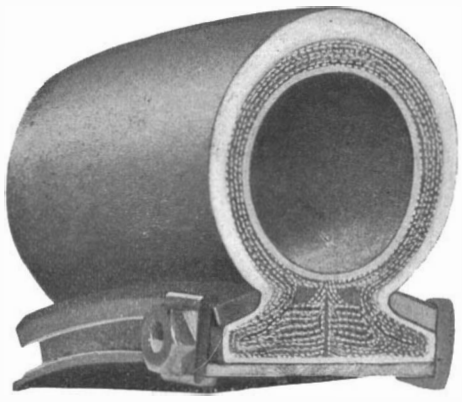
A NEW DETACHABLE TIRE.

The present vogue of detachable pneumatic tires for automobile use has been increased, if anything, by the invention of a tire that is readily detachable with the use of no tool other than a small monkey wrench. Our cross-sectional cut shows very clearly how this is accomplished. The outer tube, or "shoe," of the tire is formed with two flanges flat on the bottom and slightly tapered on their upper edges. These flanges are pressed against each other and the wheel rim by clamping rings slipped over them from each side. The rings are clamped tightly against the flanges by small clips on bolts that pass through the latter from one side to the other of the tire. The clips engage the wheel rim and the clamping ring, and press the



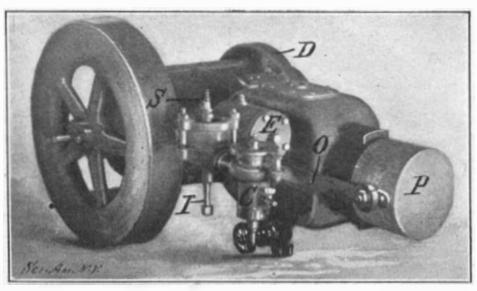
FISK DETACHABLE TIRE.

flanges firmly between the two. The method of clamping on the outer tube is entirely mechanical. As it does not depend on the air pressure in the tire, the latter can not pull off, even if deflated, while the ease and dispatch with which it can be removed, render punctures no longer so much to be feared by the motorist.

A DOUBLE-PISTON GASOLINE MOTOR.

Our illustration shows the double-piston 10 horse power motor used on the Shelby automobile. Although this type of gasoline engine has been used in America for the past ten years, the Shelby is the first to use it here on an automobile, notwithstanding that three or four French machines have used it successfully for some time.

The motor has two pistons, each of which has a 5-inch stroke and works in a cylinder having a 6½ inch bore. The explosion occurs between the pistons and drives them apart. One is connected to the crank shaft in the usual manner, and the other, which is shown covered by a cap, *L*, is connected through side connecting rods, *O*, to two other opposed cranks on the crank shaft. Thus a push and a pull are communicated to it at the same instant by the two pistons, the entire force of the explosion being transmitted directly to the crank shaft. Besides requiring but one set of valves and one spark plug, this arrangement furnishes a well-balanced motor. In the cut, *E* is the exhaust valve chamber, *I* the inlet valve, *C* the carbureter, *S* the spark plug, and *D* the slow-speed gear drum. The inlet valve is suction-operated. The carbureter has a float-feed chamber with cork float and a central inlet pipe rising to the level at which the gasoline is to be kept. As soon as the level falls



DOUBLE-PISTON GASOLINE MOTOR.

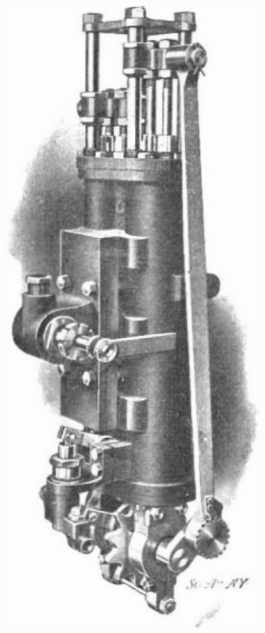
below this pipe, the valve is opened and more gasoline flows in. To speed up the motor a circular plate on top of the carbureter is turned slightly, a screw thread causing it to rise and admit more auxiliary air between its edge and the top of the carbureter proportionally as it opens the needle valve. This keeps the mixture constant, while at the same time feeding more gas to the motor.

The transmission gear is of the planetary type, giving three speeds and a reverse. The latter is obtained by sliding planetary pinions in mesh with internal gears in drum, *D*. The first and second speeds forward are obtained by the application of band brakes, while on the high gear the whole system is locked together, thus allowing of a very efficient and quiet drive by chain to the rear axle.

A double-cylinder motor of this type, with four pistons, is used in the tonneau car of this company, while the neat runabout with let-down front seat is fitted with the single-cylinder engine. Both are very easy, quiet-running cars, due to the improved type of motor.

A VALVELESS AUTOMOBILE STEAM ENGINE.

An exceedingly compact and simple automobile steam engine is the 5 horse power Fox motor illustrated herewith. This engine has no valves whatever, with the exception of the throttle seen on the center of the steam chest in front. The steam is let into the cylinder and cut off at one-half the piston stroke by an arrangement of the parts, whereby each cylinder and piston act as a valve for the opposite ones for both the inlet and the exhaust. The engine has two 2½ x 3-inch cylinders. Two piston rods from each piston project through brass stuffing boxes in the top of the cylinders, and drive crossheads with adjustable bearings, connected to the crank shaft by hand-forged driving arms. The crank shaft is fitted with ball bearings throughout. An eccentric-driven pump at the bottom of the engine supplies water to the boiler.

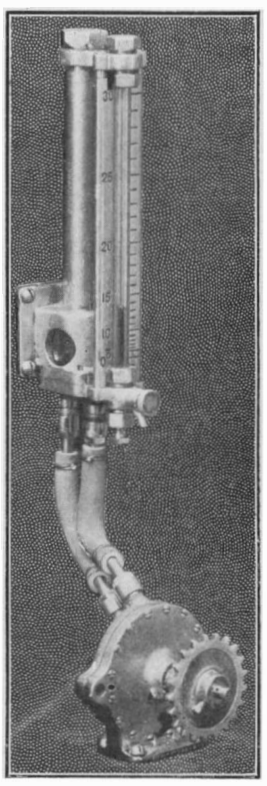


VALVELESS STEAM ENGINE.

This motor has only about one-third as many parts as the ordinary slide-valve engine; and it can not be damaged by sudden reversing, as steam is cut off by the throttle during this operation. The stuffing boxes are readily accessible, and, since they are on the top of the cylinder, the packing is not injured by water from condensed steam, when the engine cools.

A DEVICE FOR INDICATING THE SPEED RATE OF AUTOMOBILES.

A novel form of speed indicator for automobiles is shown in the accompanying illustration. This tachometer, while depending upon centrifugal action for its operation, differs from other types in applying this force directly to a liquid which is raised or lowered in an indicator tube in a fixed ratio to the speed at which the vehicle travels. The centrifugal action is exerted by a small pump consisting of a casing inclosing a paddle-wheel mounted therein. The shaft on which the paddlewheel is mounted projects from the casing and is provided with a sprocket wheel, which is suitably connected by a chain with one of the wheels. The indicator portion of the instrument, which is preferably placed on the dashboard, comprises two vertical tubes communicating with each other at their upper ends. One of these tubes is the reservoir and the other, which is made of glass, is the indicator. These tubes are connected by rubber tubing to the pump, the reservoir communicating with the casing at the center, and the indicator at the periphery. A colored liquid, preferably alcohol, is placed in the tube. Normally, when the pump is not in action, the liquid will stand on a level with the zero mark on a scale placed back of the indicator tube. When the vehicle is in motion, the paddlewheel is rotated. This serves by centrifugal force to draw down the liquid in the reservoir tube and force it up in the indicator tube. The difference in level of the liquid in the two tubes will be proportional to the square of the speed of rotation, and this is allowed for by the graduations on the scale. In case of an excess of speed, the liquid is not lost, but flows over into the reservoir at the top. In adjusting the instrument, the cap at the upper end of the tube is removed and sufficient liquid poured in at the top or drawn off through a stopcock at the bottom to bring the level to the zero mark. Once adjusted, the instrument needs no further attention, for, since it is inclosed and sealed, no evaporation can take place. The absence of springs, pivots, small details, and a multiplicity of wearing parts is a commendatory feature of this type of speed indicator.



VEEDER TACHOMETER.

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Notes and Queries.

HINTS TO CORRESPONDENTS.

Names and Address must accompany all letters or no attention will be paid thereto. This is for our information and not for publication.

References to former articles or answers should give date of paper and page or number of question.

Inquiries not answered in reasonable time should be repeated; correspondents will bear in mind that some answers require not a little research, and, though we endeavor to reply to all either by letter or in this department, each must take his turn.

Buyers wishing to purchase any article not advertised in our columns will be furnished with addresses of houses manufacturing or carrying the same.

Special Written Information on matters of personal rather than general interest cannot be expected without remuneration.

Scientific American Supplements referred to may be had at the office. Price 10 cents each.

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Minerals sent for examination should be distinctly marked or labeled.

(8916) J. E. W. asks: 1. Can I make a good durable lacquer to dip small malleable iron articles, to give them the color of brass? A. You can make a lacquer of clear, light-colored shellac dissolved in wood alcohol and colored yellow with any of the soluble yellow pigments. 2. Would the lacquer be durable on the articles if handled much? A. The lacquer will not be durable to handle in the use of the articles. 3. If the above is not practicable, give a description of a brass plating plant and the process of plating, with the estimate of what it would cost for a small plant. A. For a description of other processes for coloring by dipping, and plating by dipping and by electro-plating we refer you to Brannt's "Techno-Chemical Receipt Book," $2 by mail. 4. Would the same plant be used for bronze and nickel plating? A. The bronzing and nickel plating processes are also fully treated in the book.

(8917) H. E. M. writes: Can you furnish me a receipt for a waterproof glue or cement that will hold emery as hard as common glue will? A. Melt together one part of shellac and one part of resin; when uniformly mixed, stir in one part of carbolic acid, crystals.

(8918) F. H. K. asks: 1. How much water pressure per square inch can be obtained from a 28-barrel tank, 21 feet from bottom of tank to ground, 1¼-inch discharge pipe reduced to ¼ or ⅛ inch at outlet? Pipe making one turn to connect with motor. Does this reduce pressure? A. You will have a pressure of 9 pounds per square inch at the ground. The friction for so short a pipe will be imperceptible. 2. I understand that the north magnetic pole of the earth is considered negative. Then the end of the compass needle pointing north would be positive. Is this so? A. The north magnetic pole is negative, and the north end of a magnetic needle is positive. 3. Are the north and south poles of a battery or a magnet the same as the negative and positive poles, respectively? A. The positive pole of a battery and of a magnetic needle are equivalents when the positive current enters at the end of a left-hand coil. The entrance of the current in the coil is its north pole.

(8919) J. A. R. asks for a formula for a good black varnish for rubbers and rubber boots. A. The manufacturers of rubber varnishes impart the gloss by applying a coat of asphalt varnish before vulcanizing. The following rubber varnishes are all well recommended: a. Dissolve 1 part of shredded caoutchouc in 8 parts of benzol, and then add 2 parts copal oil varnish. b. Carefully melt 1 part of colophony, then add gradually ½ part of finely shredded caoutchouc, stirring thoroughly. Then add 1 part linseed oil and keep heated until uniform mixture is obtained. c. Dissolve 1 part gum dammar and ½ part shredded caoutchouc in 1 part of oil of turpentine, warming in a water bath; then add 1 part of linseed oil varnish. d. Mix 1 part caoutchouc, ½ part lard, and 6 parts good fish oil, and heat in a water bath, stirring until all is dissolved. Apply warm. This is claimed to give an excellent glossy coat. 2. Also a formula for the best dry powder fire extinguisher (such as is sold by some New York firms), one that will extinguish an oil fire. A. Bicarbonate of soda and sal ammoniac, both very dry, and kept in a dry place, make as good a dry powder fire extinguisher as can be made. If mixed with a little finely powdered mineral matter, such as tripoli, there will be less tendency toward caking.

(8920) H. S. M. asks for the ingredients and proportions for making a rubber cement from raw rubber which will stand hot water. I want to use it for repairing rubber boots, such as patching, putting on soles, etc. A. 1. Dissolve 1 part of shredded caoutchouc in 30 parts of carbon bisulphide. 2. Melt together 1 part of shredded caoutchouc and ½ part of colophony; when cool, dissolve in 3 to 4 parts of oil of turpentine. Mix solutions 1 and 2 for use.

(8921) E. R. B. writes: Will you send me one or two formulas for chemicals used in dipping gas mantles to render them incandescent under heat? A. The incandescent gas mantle, or Welsbach mantle, is made as follows: A mantle is woven of cotton in the proper form, and is dipped into a solution of the mixed thorium and cerium nitrates, dried and redipped until the cotton is sufficiently impregnated. When this is ignited the cotton burns away, and the nitrates are decomposed to oxides, in which form they incandesce vividly. The best light is obtained when the mixture consists of 99 per cent thorium oxide and 1 per cent cerium oxide. Other earths have also been used; such as lanthanum and didymium; zirconium and magnesium have also been tried, but the thorium-cerium mixture gives the best light. These rare earths can be purchased in quite pure form, but are expensive. Commercially, they are obtained from monazite sand. Their manufacture is largely controlled by the Welsbach companies.

(8922) W. H. K. asks: In connecting a pump to a boiler, where should the feed-valve be—between the pump and check-valve or between the check-valve and boiler? A. A valve or cock should always be placed in the feed pipe next to the boiler, and only used for contingencies, or examination of the check-valve, which should be in front of the valve or cock. Another valve at a convenient place should be used to regulate the boiler feed.

(8923) L. J. S. writes: We have just finished a brick stack 125 feet high, 48-inch flue, for our new plant and I wish to have a copper lightning rod placed on same—a copper cable rod about 17-32 inches in diameter, 28 strands, in shape of a cable. Now there is a cast iron cap on this stack, to which I wish to fasten the copper rod and then encircle the whole cap with this rod and have copper points, say about 8 inches long to the number of about ten, placed all around edge of cap; rod to be well grounded. Also is there any danger if rod is grounded inside of boiler house, or is it safer to keep it on the outside? A. Your method of arranging the lightning rod is correct. We advise you to carry the lightning rod over the roof of the boiler house and ground it outside to the water line or to a well. If you know the depth of the water line an iron rod driven to the water makes a good ground connection.

(8924) C. A. A. writes: I burn brick in a brick yard, and in burning the brick, there are, after opening the kiln, some brick entirely burned up, and I would like to know what kind of stuff there is in the clay that causes these brick to burn into dust? A. The quality and strength of your brick depend upon the proper proportion of pure clay in the mixture. If you are turning out of your kilns good and bad brick you should know your system of mixing and the proportions of pure clay and sand, or possibly you are using a clay marl that does not run even. We advise you to make a study of "Sixty Years a Brick Maker," by Crary.

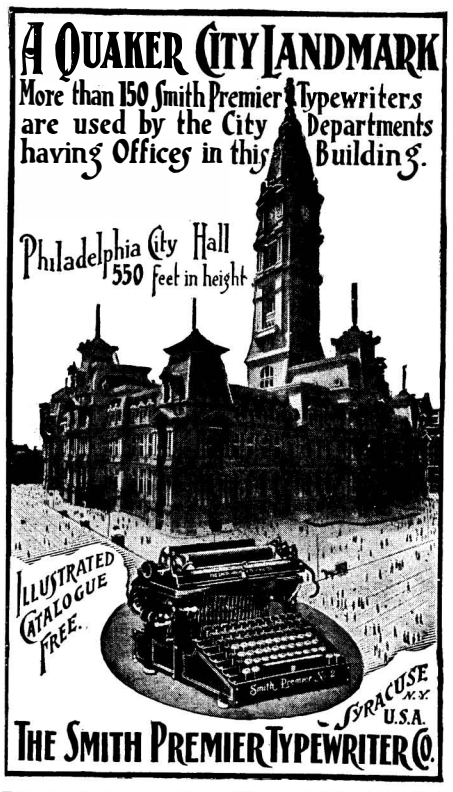
(8925) C. A. P. asks: 1. What is the average per cent of loss of power in gearing a wheel to 250 revolutions a minute from a wheel making one revolution a minute? A. Change of speed does not change or lessen power further than is caused by the actual friction of the wheels or belts used in the change. 2. Is this average the same in all instances where the ratio is the same as the one mentioned? A. It is not always the same by the different methods of making the change of speed, and is a matter of friction only. 3. When obtaining power from a weight, how heavy would the weight have to be to give one horse power? A. 33,000 pounds falling one foot per minute or its equivalent of weight and feet are equal to one horse power.

(8926) C. V. F. asks: What would you use to best advantage to clean greasy articles to be soldered where it is not necessary to use the scraper if it was not for the grease? I have used carbonate of potash and soda solution but not with good results. What is best to use to lift the solder from the bar with the copper? I keep it clean, but it does not lift the way it ought to. How do you prepare the sal ammoniac for soldering purposes? A. Hot water and soda should be sufficient to clean grease from work to be soldered. To charge the copper with solder, draw it from the end of a solder stick. For a solution, dissolve zinc in hydrochloric acid to saturation, to which add a little sal ammoniac and water.

(8927) J. G. H. asks whether surveyors make any allowance for the curvature of the earth in surveying large tracts of land or bodies of water. A. The curvature of the earth is always a factor in accurate surveying. The United States Geodetic Survey makes a fine point of this element. The curvature for one mile is 0.667 of a foot, and for three miles it is 6 feet. An appropriate rule is, two-thirds the square of the distance in miles equals the curvature in feet. The South Atlantic Ocean has not been fully surveyed.

(8928) A. M. B. asks where he can procure the metal bismuth in sheet and insulated wire form? A. Bismuth is a brittle metal, and cannot be rolled into sheets or drawn into wire. It can be cast into thin plates and short wires.

(8929) L. G. H. asks: Define clearly what is meant by a "radially expanding" propeller wheel? Is there such a thing as a "radially diminishing" propeller wheel? A. A radially expanding propeller blade increases in width from the hub outward on a curved line. Wheels have been made that swell in width in the middle and narrow toward the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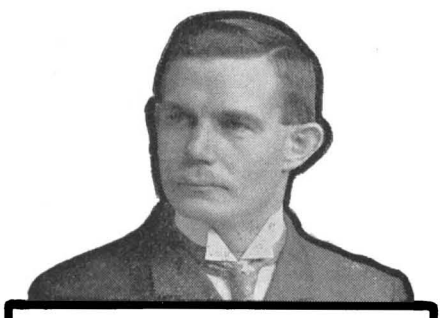

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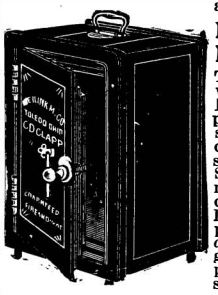

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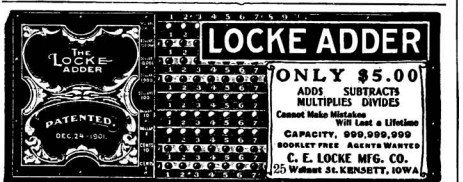

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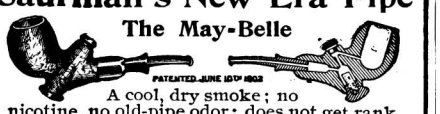

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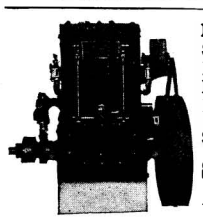

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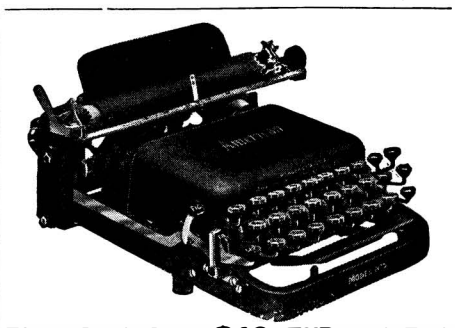

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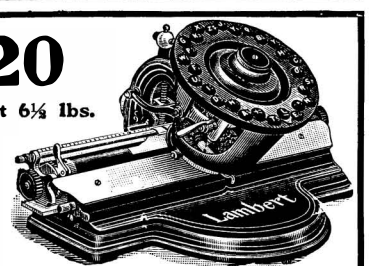

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end of the blades. They may be called radially diminishing blades.

(8930) F. H. P. writes: Will you kindly explain through your inquiry department the chemical action which takes place in the manufacture of Portland cement from lime rock and shale, and why the two, when combined in a wet state and burned, will produce a cement which hardens as hard as a rock, while either element when burned and combined dry will only make a lime plaster or a substance which is not hard at all? A. A great deal of investigation has been done to determine the reason and reactions in the setting and hardening of cement. Briefly summed, the conclusion reached and apparently now fully established, is that, in the process of burning, the clay and lime combine, forming basic silicates and aluminates of lime, which then with water form crystalline hydrated silicates and aluminates respectively, thus causing hardening. If it be borne in mind that the crystalline hydrated silicates closely correspond to the zeolites of nature, and the crystalline aluminates to the spinels, the hardening is readily understood. This explains also why a mixture of burnt clay with burnt lime, does not yield a cement; in this case there is no combination between the clay and the lime, and consequently the lime simply slakes with water in the usual manner.

(8931) G. W. L. asks for the cost of production of chlorine gas by some process in commercial use. A. Descriptions of processes are freely found in chemical literature, but costs are rarely published. We give here a few references: Ludwig Mond, presidential address before chemical lecture at British Association meeting, 1896, gives a good description of the processes to date, but no costs. George E. Davis, Journ. Soc. Chem. Ind. xvi. 11,-868, reviews processes to date, and gives following costs for bleach, per ton, including all manufacturing and general expenses: By Deacon-Hasenclever process, £5, 6s. 9d; by nitric acid process, less than £4,-6s, 9d; by Welden process, £5, 6s, 7d. The electrolytic processes had then not been perfected. John B. C. Kershaw, electrician, June 15, 1900, gives figures as to the actual and relative cost of electrolytic chlorine, when used in the work of bleaching goods. F. Oettel, Zeitschieft für Electrochemie, 1900, 7. (21) 315-320, and V. Engelhardt, same journal, 1901, 7 (27) 390-396, gives figures as to cost of bleaching by the Haas-Oettel and Kellner apparatus. Engelhardt takes into account the varying costs of salt and electrical energy. J. B. Swan, Jour. Soc. Chem. Ind. xx. 7, 662; B. E. F. Rhodin, same journal, xxi, 7, 449; and C. P. Townsend, Elec. World and Eng.. April 5, 1902, describe modern electrolytic processes and give figures as to the output per electrical horse power, but none as to cost. Valuable data will be found in Census Bulletin No. 210, on Chemicals and Allied Products, but even here figures as to costs are not given. The Census Department might be able, however, to give such figures, or put you in the way to obtain same.

(8932) J. M. M. wants to know the best known preparation for preserving old and new shingle roofs, also tin—a preparation of coal tar or pitch, with some other ingredient in it to harden it, so it will not run when exposed to hot sun or crack in frost and winter. A. A good quality of pitch, mixed with creosote oil to the consistency of paint, is often used on iron and wood. Pitch thinned down with turpentine or carbon bisulphide gives excellent results and will dry out hard. Care must be taken when using carbon bisulphide as it is highly inflammable; also, it has a very disagreeable odor. Rosin is sometimes added and is claimed to give a better and more durable coat. We know of one concern who claim to add a small amount of rubber, stating that they obtain in this way a paint which adheres well to tin roofs and will outwear the usual linseed-oil paint. If care be taken to secure a good, rather hard pitch, which has not been burned in the distillation, it should not soften to any considerable extent under the usual heat of the sun.

(8933) G. S. K. asks how to compute the width of the brushes for a six-pole armature intended for a current output of 420 amperes. The armature, he says, is provided with a multiple-circuit winding. Each brush stud will have four brushes ¾-inch thick. A. The data for calculation of copper and carbon brushes, as to pressure, contact resistance, and friction, are given in an article in the Electric Engineer, New York, August 7, 1895. As this journal is no longer published, you may not find it except in a library. We have not access to it ourselves, and cannot give you any result attained by the authors. The carrying capacity of copper is from 2,000 to 4,000 ohms per square inch cross section. From this the bearing surface can be easily found, with a liberal factor of safety.

(8934) G. W. T. asks for the name of an article that when added to glue will keep it in liquid form; if so, the quantity per pound of glue before dissolved, also proportion of water to one pound of glue. A. 1. Boil together for several hours, 10 parts of good strong glue, 26 parts of water and 1½ parts of nitric acid. 2. Soak good glue with water, then melt in the usual way, and stir in strong vinegar or acetic acid until a solution is obtained which will be of the right consistency when cold.

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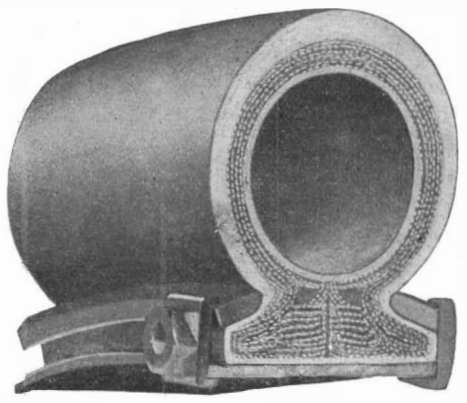

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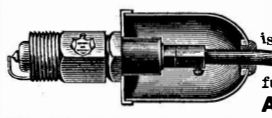

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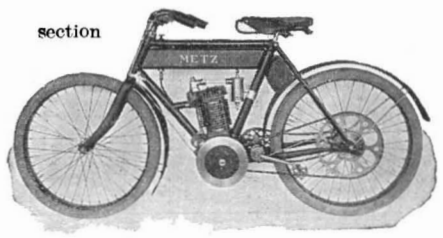

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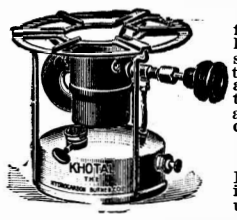

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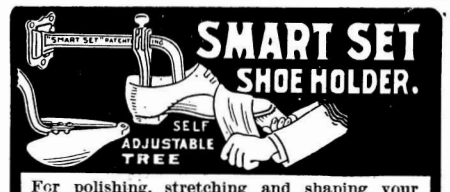

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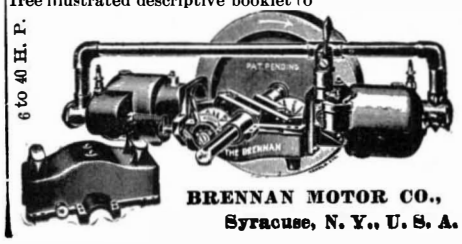

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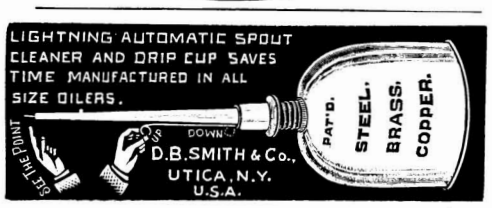

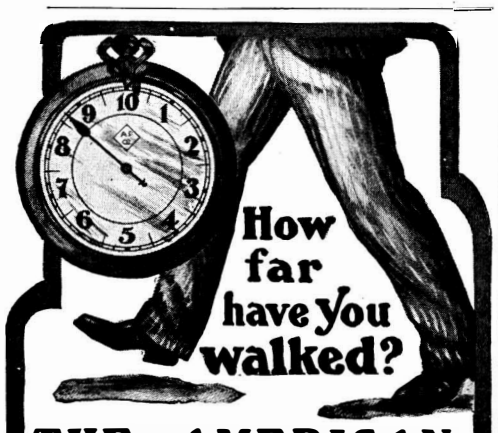

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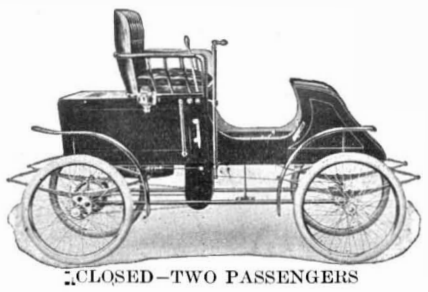

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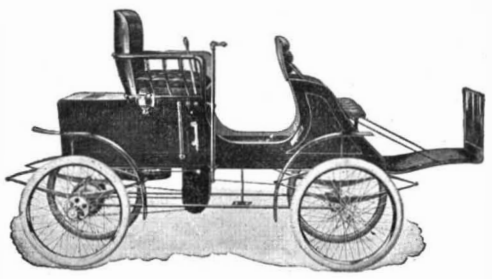

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NOTES ON LAYING, REPAIRING, OPERATING, AND TESTING SUBMARINE CABLES. U. S. Signal Corps. Prepared under the Direction of Brigadier-General A. W. Greely by Captain Edgar Russel. With Supplementary Chapter on Factory Testing by Lieutenant-Colonel Samuel Reber. Washington: Government Printing Office. 1902. Pp. 70.

LOCOMOTIVES: SIMPLE, COMPOUND, AND ELECTRIC. By H. C. Reagan. 12mo. Pp. xiii, 604. Price $2.50.

This edition describes and illustrates by means of photographs and detailed drawings the latest improvements in locomotive practice. This includes the latest types of compound and single-expansion locomotives, and treats of many improvements in fire-boxes and boiler construction.

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The new matter is intended to put the reader in touch with the very latest and highest type of locomotive and its details.

THE ANALYSIS OF STEEL-WORK MATERIALS. By Harry Brearley and Fred. Ibbotson. London, New York, and Bombay: Longmans, Green & Co. 1902. 8vo. Pp. xv, 501.

No author could possibly choose the best from the continually increasing number of ways of analyzing steel works materials and prove his chosen methods at every point. Although this has been the ideal of the authors they frankly admit that they have not accomplished it. Nevertheless they have described no method that has not been personally verified and practised for a considerable time, except in one or two minor cases, dealing with estimations. Furthermore, in writing up the description the authors simultaneously worked through the operation so that no feature might be overlooked which was needful to a complete appreciation of the process. Most of the typical analyses given were obtained in this way. It follows, therefore, that the book is eminently practical.

ASTRONOMY WITHOUT A TELESCOPE. By E. Walter Maunder, F. R. A. S. London: "Knowledge" Office. Pp. xx, 280. Price $2.50.

In 1900 the author commenced a series of short papers in "Knowledge" upon the zodiacal light and other objects, which, like it, need no optical assistance for their examination. Out of that series of papers the present volume has grown. After an introduction and a section on constellation studies, the author passes to astronomical exercises without a telescope, in which he discusses the sun and the seasons, the morning and evening stars, the march of the planets, and sunspots and moon-spots. In his third section the author discusses astronomical observations without a telescope, and treats of meteors, zodiacal light, auroræ, the milky way, new stars, the structure of comets, a total solar eclipse, etc.

JENA GLASS AND ITS SCIENTIFIC AND INDUSTRIAL APPLICATIONS. By Dr. H. Hovestadt. Translated and edited by J. D. Everett, M.A., F.R.S., and Alice Everett, M.A. London: Macmillan & Co., Ltd. New York: The Macmillan Company. 1902. 8vo. Pp. xv, 419. Price $5.

This book is mainly devoted to an account of the physical and chemical properties of the various types of glass which have, up to the present, been produced at the Jena glass-making laboratory and to the indication of their scientific and industrial applications. The experimental and theoretical investigations relating to these glasses are scattered through various journals, or have been published as separate monographs. That they have here been collected, edited and presented in book form, is a task for which Dr. Hovestadt deserves thanks. The work of the translators cannot be too highly commended.

One of the functions of the Smithsonian Institution, at Washington, is the diffusion of knowledge in popular language.

The popular volume before us contains fifty articles, many of them illustrated, nearly all prepared by masters of the respective subjects, telling in clear and interesting language of the latest progress in all the principal branches of knowledge.

"Bodies Smaller than Atoms" is the title of an interesting paper, and as we read "The Laws of Nature," "The Greatest Flying Creature," and "The Fire Walk Ceremony at Tahiti," we are reminded of the wide range of subjects included in the Report. Wireless telegraphy, transatlantic telephoning, and the telephonograph are discussed by experts in electrical progress. Attention ought also to be called to papers on utilization of the sun's energy, the Bogosloff volcanoes of Alaska, forest destruction, irrigation, the Children's Room at the Smithsonian, the submarine boat, a new African animal, pictures by prehistoric cave-dwellers in France, automobile races, the terrible lizards that once lived in America, and Mr. Thompson Seton's paper on the National Zoölogical Park at Washington.

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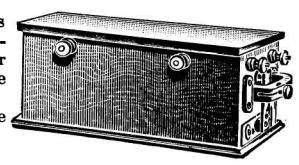

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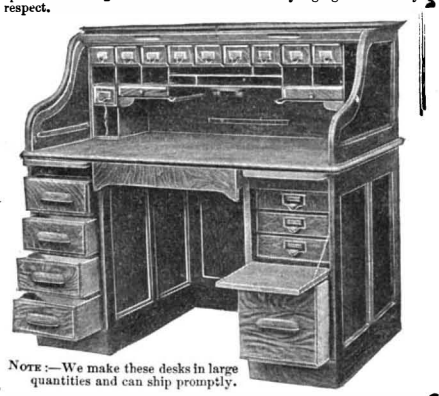

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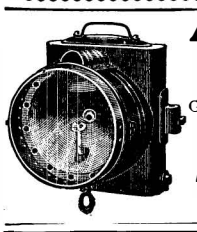

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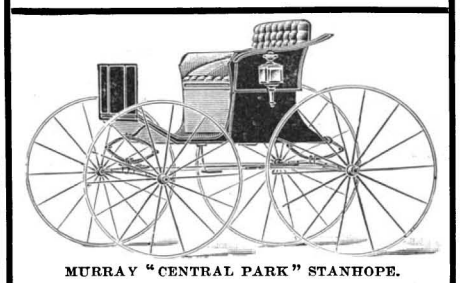

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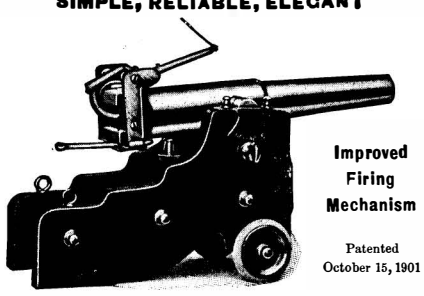

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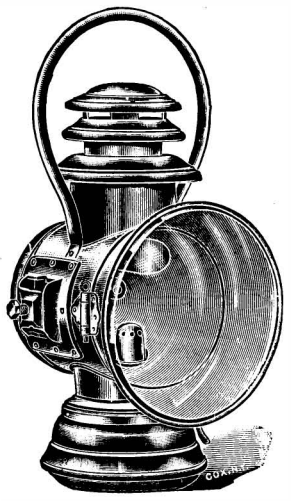

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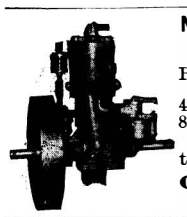

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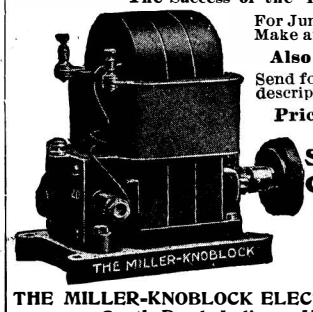

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RECENTLY PATENTED INVENTIONS.

Agricultural Implements.

ELEVATOR FOR CORN OR GRAIN DUMPS.—J. MABUS and F. L. HAY, Lilly, Ill. This elevator and conveyor for grain dumps has a multiple of shafts connected with the driving mechanism enabling power to be applied, no matter what position the machinery may occupy. The conveyor and elevator may be adjustably connected so that their belts will have guided movement, and means are provided for safely receiving, holding and conducting quantities of material.

Engineering Improvements.

HYDRAULIC DREDGE.—J. ANDERSON, Gulfport, Miss. This improvement belongs to that class of dredges which are adapted to float. The inventor in this improvement makes the dredging mechanism proper in the form of attachments to a boat or scow provided interiorly with chambers or tanks for receiving the mud, sand, silt, and water taken up by a suction-pipe.

Tools.

FLUE-CUTTER.—E. E. RESOR, Vanwert, Ohio. This inventor has made an improvement in devices for cutting boiler flues or tubes at the inner side of the flue sheets, and in providing a device of this character he makes it possible to quickly cut a flue with very little exertion on the part of the operator, and also prevents the shock incident to hammer-actuated cutters.

HOG-NOSE CUTTER.—C. F. ROUX, Stryker, Ohio. Comprised in this improvement are means for cutting off the nose of a hog or that part with which the hog roots. The invention provides a simple device with the cutting-blade so curved and extended as to cut away all the rooting portion of the nose of the animal. The implement is also intended for use as an ear-marker.

Mechanical Devices.

BASKET-MAKING MACHINE.—C. ENGBERG, St. Joseph, Mich. In its general form this machine embodies two work-holding devices, including means for feeding the hoops with a step-by-step motion and a single stapling mechanism, which is mounted to work alternately over the work-holding device, so that one basket may be operated on while another is being adjusted on the other holder. It is especially intended for putting into place the bottom hoops of bushel-baskets.

DRIVING APPARATUS.—J. H. INGGOLDSBY, Council Bluffs, Iowa. For the purposes of this invention the apparatus is provided with means for driving posts, piles, well-tubing and the like. It is mounted on a wheeled body, so that it may be readily removed from place to place, and is mainly adapted for farm and ranch use for driving fence-posts, etc., and for railway companies in fencing in their lines.

COTTON-CLEANER ATTACHMENT FOR GINS.—M. RUTH, New Edinburg, Ark. In ginning cotton the material is subjected to sharp, quick strokes of the saw-teeth, which strike it in rapid succession, and the dust, dirt, and other foreign substances contained in the cotton are thereby loosened and freed from it. The inventor here employs improved means over those used in the air blast method of cleaning and removal. The draft-passage is adapted to any common type of saw-gin.

CAN-HEADER.—L. C. SHARP, Omaha, Neb. By means of this invention round and square cans may be headed, the machine being built so that it may be readily changed to work on different sizes and forms; also its operation is such that ends or heads are simultaneously placed in the can and crimped. By means of novel mechanism the machine is rendered wholly automatic, the can bodies and heads or ends being placed in chutes and fed from the machine.

COPYING-LATHE.—C. SEYMOUR, Defiance, Ohio. Woodworking machinery receives an improvement in this provision of a new copying-lathe for turning gun-stocks, shoe-lasts, and other articles of regular or irregular form. It is arranged to permit convenient adjustment for turning the articles of the same or of a proportionate larger or smaller size than the pattern.

ADDRESSING-MACHINE.—H. L. GAY, Monticello, Ia. Mr. Gay in this invention has brought about the development of a machine that relates particularly to apparatus for severing printed names and addresses from strips of mailing-papers or the like. In the operation the strip of paper is drawn over the adhesive brush and fed through the front of the machine in an intermittent manner. The projected portion bearing a name will be severed by the cutter, and the blade projection will press such severed portion upon a wrapper. The machine may be provided with legs, or securely fastened to a table.

CLUTCH.—E. DYSTERUD, Monterey, Nuevo Leon, Mexico. This clutch is especially designed to be used with alternating current electrical motors, the object being to keep the clutch inactive till the full speed of the motor is attained and then instantly to connect the motor with its load. The inventor attains this end by providing a centrifugally operating clutch and fitting it with centrifugally controlled means for restoring the action of the clutch until a certain speed of ro-

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tation has been reached, whereupon the centrifugally controlled means permit the immediate application of the clutch thus connecting the motor with its load.

BASKET-MACHINE.—C. ENGBERG, St. Joseph, Mich. This invention relates to basket-machines, more particularly of the type used in making the so-called "bushel-baskets." The inventor's object has reference mainly to mechanism for providing the basket with staples and for clenching them from the inside of the basket. The inventor informs us that the machine is very rapid in action, and the clenching of the staples is perfect.

COPY-HOLDER.—C. B. TOWERS, Miles City, and W. A. CAMERON, Stacey, Mont. It will be found that by very little skill an operative may use this invention so as to keep track of the language being copied, no matter how irregularly the lines may be spaced and no matter whether the words are crowded in certain lines and scattered in others. It makes no material difference whether the subject to be copied contains few or many paragraphs. The improvement is somewhat similar to an invention previously filed by these inventors.

TIRE-SET.—J. B. KIMBELL, Alpharetta, Ga. Means for shrinking or compressing tires when cold upon vehicle-wheels, so as to cause them to tightly fit the wheels, are provided in this apparatus. In use the wheel is put on the table, and spacer-blocks are disposed so that the pressure of the blocks will communicate to the tire. The nuts are then tightened by means of any suitable device. This forces the blocks firmly up to the wheel, and through the movement of the spacer blocks the tire is shrunk and fitted on the felly of the wheel.

Medical.

HYPODERMIC-SYRINGE CASE.—T. A. CHAPPELL, Bronwood, Ga. This contrivance holds a syringe and containers for tablets or the like for charging the syringe, the holder and the containers being related to each other so that one receives a charge from the other without removal, thus preventing any loss. The case renders the use of the hypodermic-syringe very convenient and admits of the needle remaining on the syringe without danger of breakage.

Railway Improvements.

GRAIN-DOOR.—M. C. ROWCLIFF, Osceola, Wis. The invention provides a sectional door which may be adapted to be placed in a railway "box-car" when the car is loaded with grain, so as to keep the grain from leaking through the crevices in the main door of the car. By means of peculiar construction and relative arrangement of parts this improvement secures advantages over doors heretofore made for this purpose.

Miscellaneous.

FENCE-POST.—W. B. WHERRY and J. B. HILL, Overton, Texas. The object which these inventors have in view is the construction of the base which is adapted to be buried in the ground, the base serving to hold the post against vertical displacement in the ground, as well as to overcome any tendency to leaning.

SHOE-STRETCHING DEVICE.—J. KARLSON, New York, N. Y. This is a convenient appliance for boots and shoes to hold the soles straight on their lower surfaces and stretch the uppers, so as to prevent transverse wrinkles forming in the shoe-leather that render the foot-gear unsightly and also injure by causing breaks in the material.

WAIST AND SUPPORTER.—SOPHIE VISCHER, New York, N. Y. This contrivance provides a waist and supporter for the bust, abdomen, and skirts, to supplant the corset, and is arranged to be supported from the shoulder-bones and hip-bones, to leave the lungs, stomach, and other organs free of pressure, to prevent disfiguration, to strengthen the back, and to offer means of supporting skirts, hose-supporters, etc.

EYE-GLASSES.—E. L. LEMBKE, New York, N. Y. The appearance of eye-glasses is heightened by this improvement, the screws for fastening the spring and the nose-clamps to the posts are locked against accidental unscrewing and the screws are protected from moisture and cannot come in contact with the skin and bruise it.

WINDOW-SASH ATTACHMENT.—P. MAYOTTE, Escanaba, Mich. This device facilitates the raising of window-sashes without using counterbalancing-weights and automatically locks the sash in any position. A spring-actuated gear is fastened on the sash and arranged to climb on a rack held by the window-frame. With this gear a shaft is used and by axial movement of the shaft the gear may be released, or it may be fastened to the sash, thus locking the sash with respect to the window-frame.

TILE FLOORING.—C. P. LAWSHE, Trenton, N. J. This flooring comprises a tile of any form or material and a bed for the tile of flexible, resilient material, this material lying under the tile with webs between the tiles and the tiles being secured to the webbing by cement or other means. This bed is constructed in sections, and when the flooring is made the tiles in the sections are laid with the bedding on the floor. The tile flooring is secured in place by passing fastening devices through holes made in certain of the tiles. This flooring is noiseless and elastic.

BUCKLE.—J. P. HUNT, Maitland, Mo. The employment of this buckle secures together portions of harness for draft-animals, mainly to such as are used for adjusting the length of traces. It is readily adjusted to lengthen or shorten a tug-strap, which dispenses with holes in the strap, as when buckles having tongues are used. It is applicable to straps of various widths and thicknesses.

CHAIR ATTACHMENT.—J. F. BLOCH, New York, N. Y. In the completion of this improvement, the inventor has furnished simple means for producing a current of air by a rocking motion of the chair and conducting it to cool the occupant. The spray of air is practically continuous.

FOLDING BED.—C. P. BROWN, Springlake, Mich. The invention relates particularly to improvements in metal folding beds. A bed of this character may be easily raised or lowered and has means to prevent its accidental folding and also for holding the bed at any desired angle, as occasion may require.

GARMENT-HANGER.—A. L. ROSS, New York, N. Y. This contrivance is a hanger for trousers and skirts which is simple and durable in construction, cheap to manufacture, easily fastened in place on the inside of a closet-shelf or like support, and arranged to permit adjustments for trousers of different waist sizes and to allow of supporting them by the buttons located outside or inside of the waistband.

SCREEN FOR PAPER-PULP.—S. H. TIBBETTS, Groveton, N. H. In devising this improvement the inventor furnishes a fastening device for securing the end plates of each section of a continuous screen used for cleaning pulp, its object being to prevent the possibility of dirt, or any extraneous matter from working under the sides or edges of the end plates.

BOOK-SUPPORT FOR CHAIRS.—T. DONOHUE, Memphis, Tenn. The means adapted for supporting the table of the chair attachment consists of a bar fixed to the table and having its ends resting upon the chair arms. A brace extends down from the under side of the table adjusted to rest upon the upper side of the chair bottom, the brace being formed of two parts secured together and capable of lengthwise adjustment.

COMBINED SIDESTICK AND QUOIN.—W. S. RHODES and W. J. TRUMP, Lincoln, Neb. This article consists of a sidestick having its inner side supplied with reversed inclines, the inner ends of which are provided with projecting lugs whose free ends have longitudinal slots formed between the upper and the lower edges of the lugs. An adjusting shaft projects at its ends through the slots and is provided at its middle with a collar fitting and working between the lugs, and the quoins have inclined faces operating along those of the sidesticks and engaged by the screw shaft ends.

COMBINED TABLE AND DESK.—F. H. DUKESMITH, Charlestown, W. Va. Combined in this one article is a table and desk capable of various uses and adjustments. When closed it will present no unusual appearance and still be a receptacle for papers, pens, ink, shaving utensils, game apparatus, a file for letters, as well as a support for a center lamp or other objects.

EDUCATIONAL APPARATUS. — L. S. PRATT, Galesburg, Ill. The object of this invention is to provide an improved apparatus for use of pupils in school and at home. One of the chief features of the invention is a rectangular frame adapted to be permanently secured to a wall and to receive and temporarily hold boards, maps, or panels designed to be used in the course of instruction.

PROCESS OF MAKING WOOD PLATES.—F. A. MANUEL, Richford, Vt. Practical experience has shown that the veneer from green stock cannot be first cut into round or disk-like shape and thereafter subjected to heat and pressure in a press for the manufacture of pressed circular-plates, because the veneer splits and cracks by shrinking until the plates are worthless. This improvement provides means to overcome these objections and to enable the manufacture of good commercial veneer articles to be carried on economically and quickly.

NON-REFILLABLE BOTTLE.—H. HAFFTEN, Woodside, N. Y. Initially this bottle can be as readily filled and emptied as any, but after it is once sealed all passages leading from the mouth to the body are closed by fixed and movable barriers, which prevent the introduction of liquid to the body of the bottle or the insertion of devices to displace the movable barriers from their closing positions.

ACCOUNT-SHEET.—R. G. WOODWARD, New York, N. Y. A new form of account-sheets is herein provided. These sheets are designed as an auxiliary to the present means of keeping books and arranged to enable the head of a business house to find the profit or loss at the close of each day without resorting to intricate bookkeeping and without disclosing to others the state of the business.

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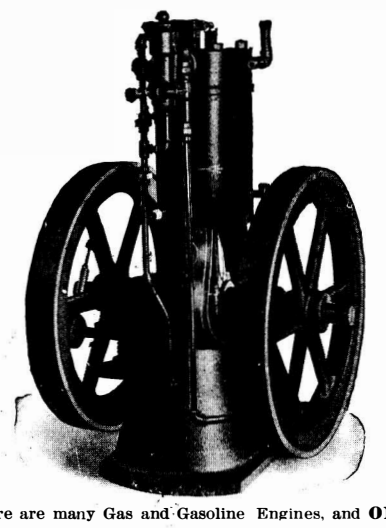

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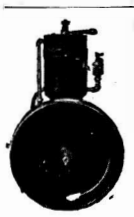

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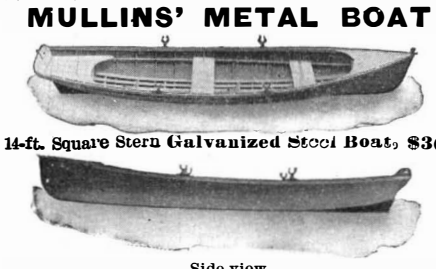

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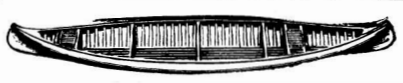

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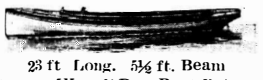

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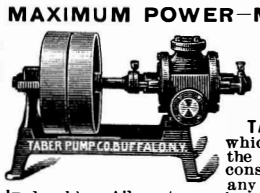

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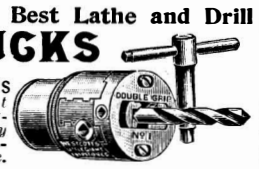

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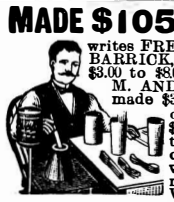

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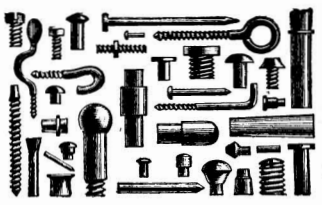

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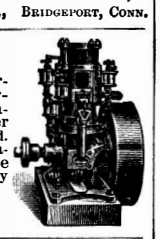

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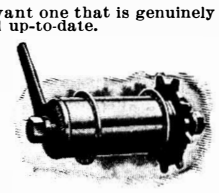

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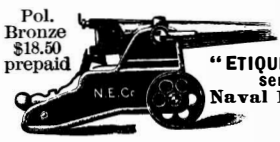

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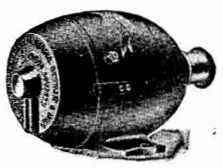

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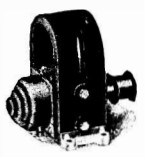

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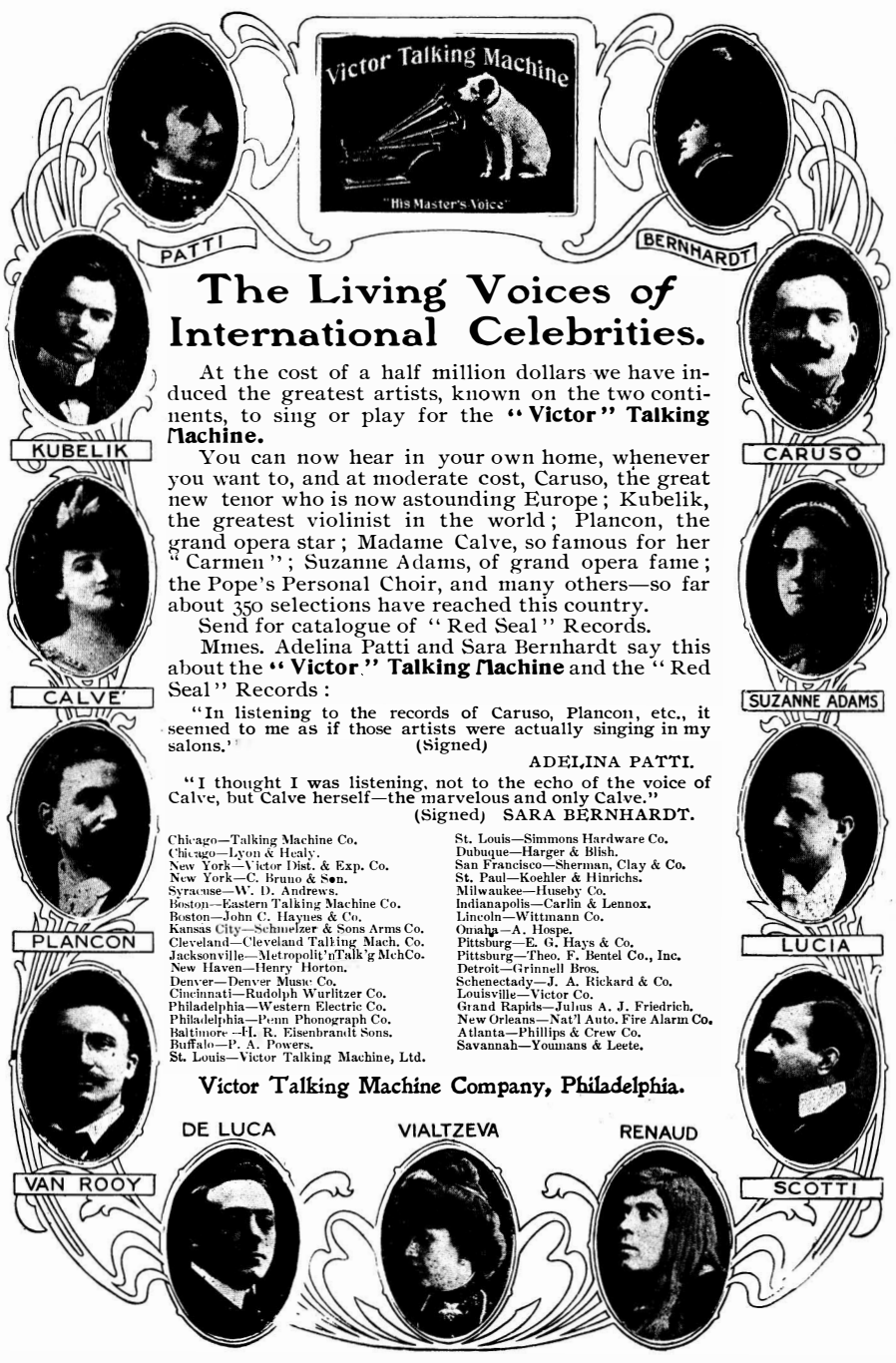

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Victor Talking Machine Company, Philadelphia.

Engineering Notes.

After standing securely for upward of 120 years, the cast-iron bridge which The Coalbrookdale Company erected over the Severn in the years 1777-1779 has failed by the sudden breaking of the girders. The structure is believed to be the first metallic bridge ever erected, and it possesses the further distinction of having given its name to the picturesquely situated riparian township of Ironbridge in Shropshire. The span of the arch is 100 feet, the width, exclusive of parapets, 26 feet, and the height from base-line to center, 40 feet, while the weight of iron in the bridge is about 380 tons. No details are at present available as to the cause of fracture, but it is surmised that "fatigue," due to long-continued vibration, may have some connection with the collapse. Cast iron for bridge building is no longer in favor, rolled iron or steel being the material generally used, but for all that, there are few wrought-iron or steel structures now being erected that are likely to remain intact for such a prolonged period as did the famous cast-iron bridge over the Severn.

The "Corrosion of Copper Pipes by Sea Water," was a subject discussed by Prof. Lett before the Chemical Section of the British Association. Speaking generally, Prof. Lett said that corrosion might arise, first, from the nature of the water. The London docks were notoriously bad, and that might be due to hydrogen sulphide, of which appreciable quantities had been found in the water there. Second, from the mechanical structure of the copper; there were always pores or cavities in the copper, and cuprous sulphide and other impurities were irregularly disseminated through it, favoring irregular corrosion. Third, from the chemical composition; the "Sappho" had, for instance, lost 10 per cent of her copper shell within a year at Portsmouth, probably on account of impurities, chiefly arsenic, zinc, and lead. He had found arsenic in his specimen—in traces only, indeed. But the arsenic alloy would be very stable, and, separating in the cooling mass in irregular distribution, would set up electrolytic currents afterward, to the detriment of the copper. This he had investigated experimentally.

Brick and concrete have been used in combination in a novel manner in the construction of a storm sewer system recently completed at Truro, Nova Scotia. The scheme was adopted as a measure of economy and its cost showed a great saving over similar sized sewers constructed of brick alone. The work was regarded as one of exceeding interest to engineers. The system laid consisted of 27, 30, and 37-inch conduits and in the larger size the brick work represented only about 130 deg., forming the crown of the arch, and in the smaller pipes the percentage of brick used was even less. The trench was dug slightly larger than the desired diameter of the conduit, the alignment and grade having been given in the usual way, and a collapsible form devised for this method was carefully put in place, supported at intervals by pieces of plank. Several of the forms were laid in the trench, end to end, at one time, and these were then bolted together in such a way that one continuous form was made somewhat less than 100 feet in length. The concrete was then placed into the trench, filling up the space around and somewhat over the forms. After being allowed to set for twenty-four hours, the forms were separated from each other and upon being collapsed, were easily taken out through the opening at the top of the conduit. The bricks were used in finishing out this opening and forming the crown of the sewer.

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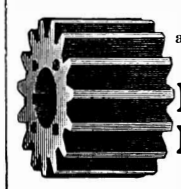

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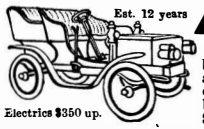

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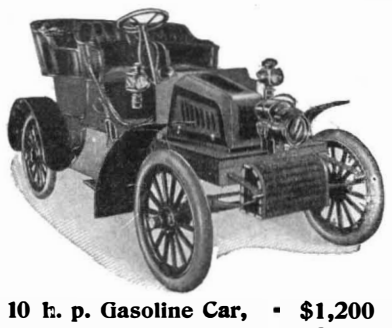

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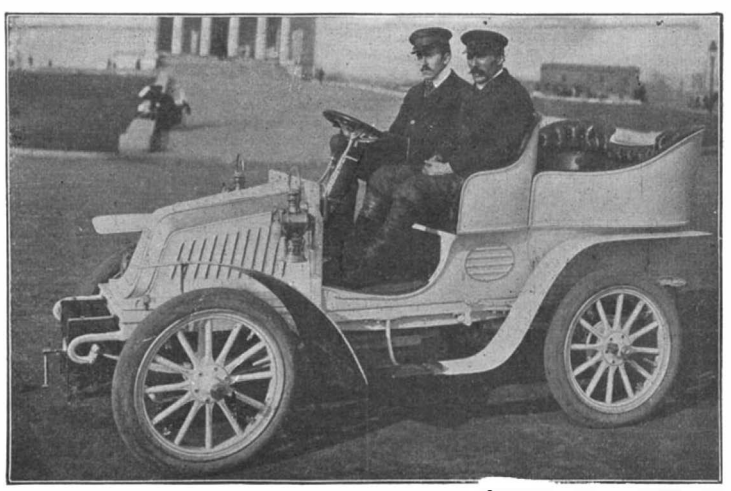

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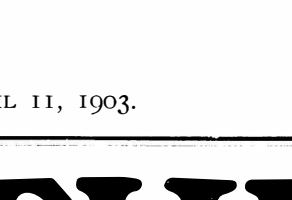

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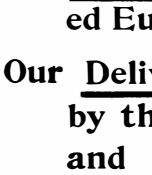

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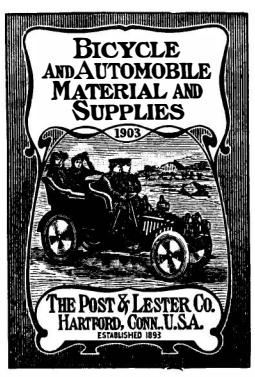

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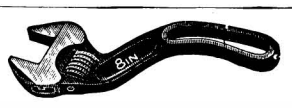

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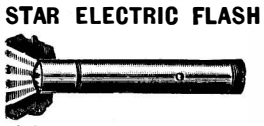

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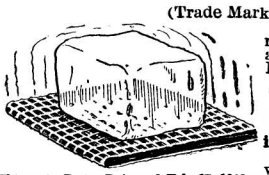

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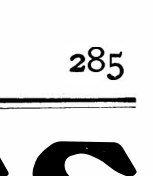

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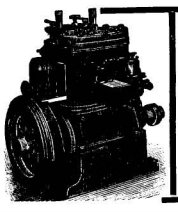

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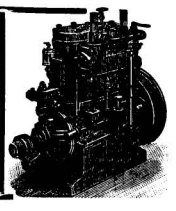

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Science Notes.

Frankel and Wogrinz confirm the statement of Hermbstdaet that the aroma of tobacco is due to a volatile basic substance distinct from nicotine and from the alkaloids isolated from tobacco by Pictet and Rotschy. This was named nicotianine by Hermbstdaet. It has been isolated from the milky aqueous distillate of tobacco leaves as the picrate of the base; this salt occurs in brilliant, silky, yellow needles, melting at 214 deg. C., which are sparingly soluble in water and in alcohol. According to Frankel and Wogrinz the aroma of tobacco is due to this base.

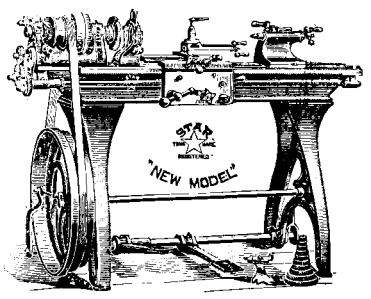
C. Hartwich and W. Uhlmann have investigated the formation of oil in the olive fruit. They find that it is present at a very early stage in the development, and increases in quantity until a maximum is reached in the month of January. The oil is not secreted in special oil cells, but occurs as drops in the protoplasm. It has been stated that the oil is derived from mannite, but this sugar has not been found to be present in the olive. It contains, however, a large quantity of glucose, which decreases in amount as the oil is formed. Glucose, therefore, and not mannite is considered to be the source of the olein.

Some interesting archæological discoveries have been made in the course of some excavations upon the site of St. Augustine's Abbey at Canterbury, England. A portion of the crypt extending westward from the three apsidal chapels has been uncovered. The south wall is in a state of remarkable preservation above the spring of the arches, and has the remains of some fourteenth-century windows. On the inner side of the ambulatory are the foundations and rubble of five massive pillars, additional to and in continuance of those discovered last year. Near one of these pillars was found the leaden coffin and coffin plate of Abbot Ulric I. (985-1006 A. D.), and further westward the body of another abbot, wrapped in silk vestments, much decayed. Pieces of copper gilt clasps were also discovered. A considerable part of the flooring, with colored and patterned tiles, is still existing, and there have been unearthed enormous quantities of worked ashlar, carved marble fragments, gilded pinnacles, and figureheads.

Mount Ararat, on which eight mountaineers recently had a narrow escape from death, attracted the attention of explorers at an early date. Sir John Mandeville estimated that it was seven miles high. Tournefort, the French botanist, attempted the ascent early in the eighteenth century, failed, and described the mountain as "one of the most dismal and disagreeable sights on the face of the earth." A little later a Persian Shah offered a large reward to any one who succeeded in climbing to the summit. Ultimately, the first ascent was accomplished by a climber who gave his name to the Parrot Spitze of Monte Rosa. The second ascent was made by one Spassky Aftonomof, in 1834, and the third by Herr Abich, in 1845. The first English ascent was made by Mr. Bryce in 1876, and since that date ascents have been tolerably frequent.

It has been observed that in the case of certain Rubiaceæ, notably *Pavetta indica* and other species, nodules or hardwarts often arise on the leaves. Inside there is no apparent cause for the hardness, since the cells are of the nature of spongy parenchyma. Dr. Zimmermann has examined these swellings and finds that the hypertrophy is due to bacteria, which swarm and fill up the intercellular spaces. How the bacteria get into the leaf has not been established. But Dr. Zimmermann observed that there is a sinking in of the epidermis in the center of each callosity, which represents the remains of a stoma that was functional in an early stage of the leaf. He therefore put forward the hypothesis that the bacteria enter directly into the leaf through the stomata.

FOOT and POWER



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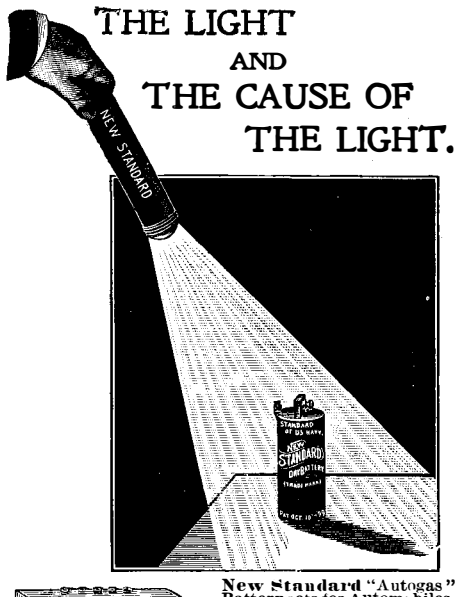

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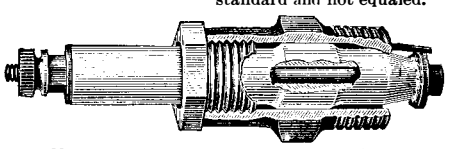

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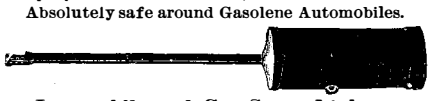

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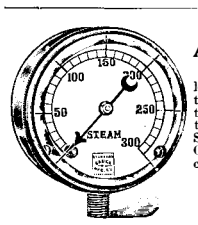

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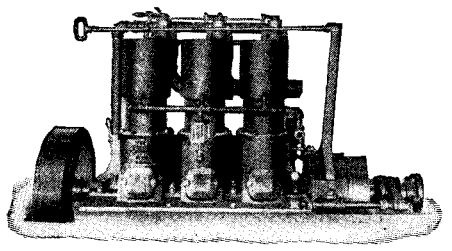

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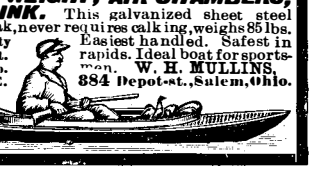

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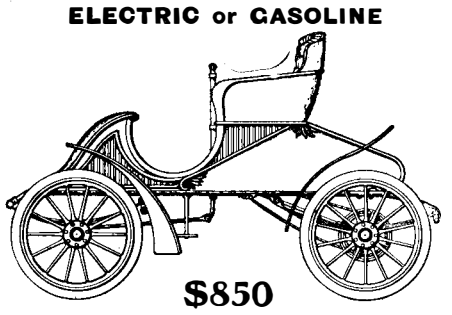

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Automobile News.

Although there are no radical changes in electric automobiles or storage batteries this year, various new models have been brought out by the manufacturers. In runabouts, there are the 1,000-pound machine of the E. V. Company, with battery and motor suspended beneath the body, thus furnishing an empty box behind for carrying articles; and the wheel-steering runabout of the National Motor Vehicle Company, built somewhat in imitation of the gasoline runabouts, with a bonnet-like box in front.

New models of larger electric automobiles are the E. V. Company's inside-operated coupé, intended for the use of physicians in stormy weather; the hansom with underslung battery; and the electric truck, of the same company. All kinds of electric private carriages, trucks, and delivery wagons are built by the Vehicle Equipment Company, of Brooklyn. The company has a large station in New York especially for storing and caring for its electric vehicles. This type of automobile is holding its own, and seems destined to do, in a large measure, the work now performed by horses.

The latest practice in steam automobiles—a practice inaugurated by the Stanley Brothers, the original inventors of the light steam machine in America—is the hanging of the engine horizontally on the running gear so that it drives the differential on the rear axle through a spur gear and pinion. This arrangement is similar to that employed on most electric carriages, and it has the advantage of simplicity, while doing away with the chain drive. The Geneva Company have adopted it, while the White Company, also, are using a direct drive, but through a longitudinal, universally-jointed shaft and bevel gears, the motor being in front, under a bonnet.

The Locomobile, Prescott, and Toledo steam machines are still of the standard runabout type, with a tubular running gear, and preferably wood or steel wheels. The first-named has wheel-steering and a sloping box front, besides many improvements, such as the engine inclosed and running in oil on roller bearings, a ratchet device that permits of easily tightening the packing of the valve stems and piston rods, and the automatic turning on of the main cylinder oiler when the throttle is opened. The Prescott still retains the box front with let-down seat, the front seat being lower than the rear one, and its footboard being provided with a dash. Hub brakes are fitted to the rear wheels of this car, the rear axle of which has roller bearings. The reverse is obtained by a pedal. The engine is encased and runs in oil. Three water pumps and two air pumps are fitted to the machine. Two of the water pumps are auxiliary steam and hand-operated ones, as are the air pumps also. Thus it will be seen that emergencies are well provided for. The Toledo car has a bonnet in front, concealing the water tank, which, together with an inclined box on the rear and a condenser in front, gives it the general appearance of a gasoline machine. The smoke pipe projects from each side panel of the seat. The link throw of the engine can be varied by a side lever. The engine can be reversed by moving the throttle lever backward. The exhaust steam passes first through an oil separator and is then condensed, a vacuum pump driven from the engine cross-head circulating the condensed water.

The gasoline automobiles for 1903 are more numerous than ever before. One of the latest models of a thoroughly well constructed closed car is the Limousine, recently brought out by the Packard Company. In this car the usual single-cylinder, horizontal motor is abandoned for a 25 horse power four-cylinder vertical one, placed under a bonnet in front. A ball governor that controls the lift of the inlet valves and varies the time of the spark is used, but can be thrown out of action when desired. The regular sliding transmission gear, operated on the

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selective system, is used, and this is connected to the rear axle by a longitudinal shaft, with bevel gear drive. A pump feeds oil under pressure to the engine cylinders and bearings, and grease to the bearings of the transmission. The wheel base of this car is 7 feet, 10 inches, and it has 36-inch wheels, shod with 4-inch tires. The chassis is intended regularly for a tonneau body, but any suitable body can be mounted on it.

The Stevens-Duryea gasoline car is a powerful runabout equipped with an 8 horse power opposed-cylinder motor and three-speed gear. The transmission is of the individual clutch type, with gears always in mesh. The motor has a flywheel of large diameter, and it is started by a crank from the seat. A throttle button on the end of the gear-changing lever acts on the inlet valves, while a single carbureter supplies both cylinders.

A medium weight machine that has met with considerable success during the past year is the Autocar 10 horse power tonneau. The same double opposed-cylinder motor that was used on the original Autocar runabout is found on the tonneau machine; but the motor has been improved in construction and is now placed transversely on the chassis, under a bonnet in front. A three-speed sliding-gear transmission, with direct, bevel-gear drive at the rear axle, is employed. The new car is fitted with wheel steering, and has many of the refinements found on all first-class machines.

One of the neatest light machines placed on the market this season is the Covert 650-pound runabout. This little car is built strong enough for touring purposes on ordinary American roads. A reachless running gear is employed, a 5 horse power motor with air-cooled cylinder and water-cooled head being mounted on the chassis in front under a bonnet. A two-speed sliding gear is inclosed in part of the differential casing. The flywheel clutch is thrown out and the brake applied by the progressive movement of a single pedal. An emergency brake on the differential is also provided.

The rapid increase of automobiles in this country has caused the establishment of numerous storage and repair stations. One of the largest and best equipped stations of this kind is the one run by Banker Brothers, in Philadelphia. It is one of three conducted by this firm in New York, Pittsburg, and the Quaker City respectively. A three-story brick building is used for the purpose. The ground floor has ladies' and gentlemen's waiting rooms, with separate entrances; a room for the chauffeurs; an office and salesroom; and a dynamo and engine room; besides the regular storage room for vehicles, in which is a washstand and three pits with stairs leading into them, from which the vehicles can be examined from beneath. Scales for weighing the cars are also provided. On the second floor there is a well-lighted repair shop with a complete equipment of bench and machine tools. A stock room adjoining it contains spare parts of many American-made machines and a few foreign-built ones. A large storage room for electric carriages, fitted with fifteen charging rheostats and a battery repair room, is also situated on the second floor. The third floor is used for storage purposes merely, and will accommodate 150 machines. An electric elevator capable of lifting two tons connects the three floors. This, as well as the machine tools, is run by electricity generated on the premises by a 26 horse power gas engine. A separate 9 horse power engine is used at night, when the building is brilliantly illuminated with incandescent and arc lights.

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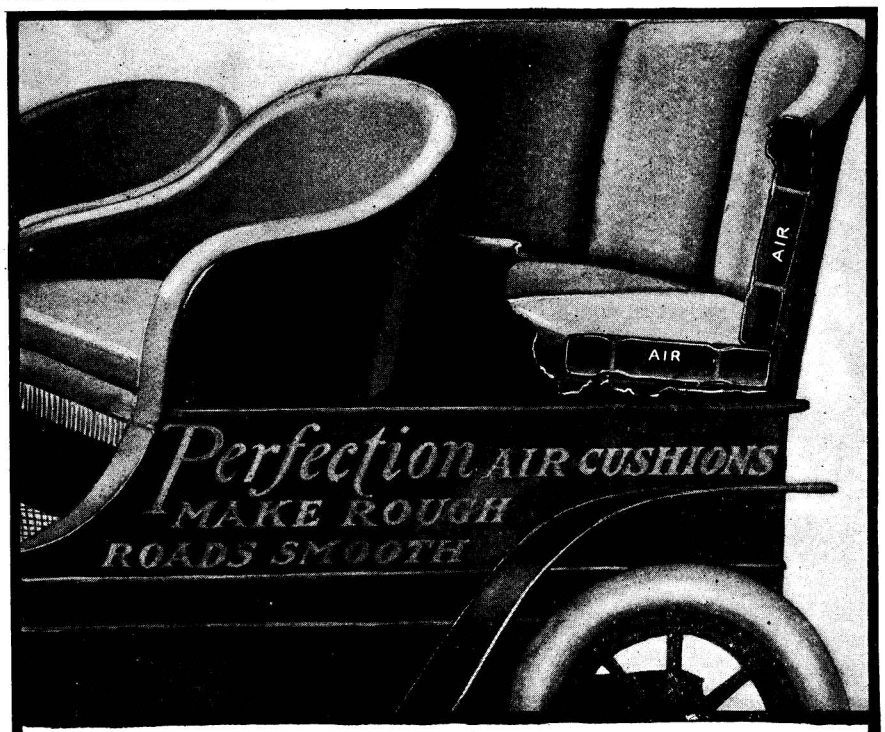

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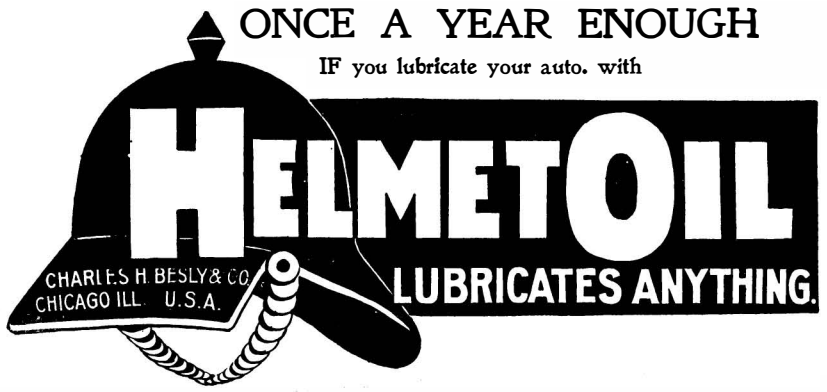

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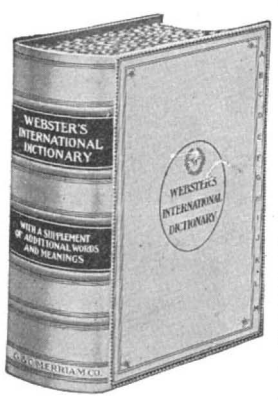
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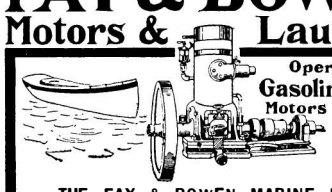

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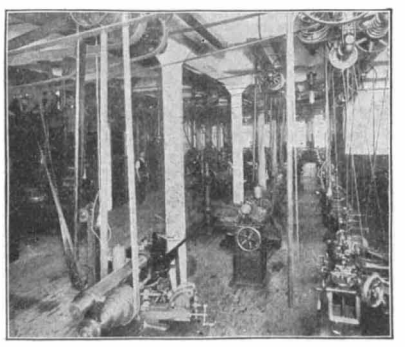

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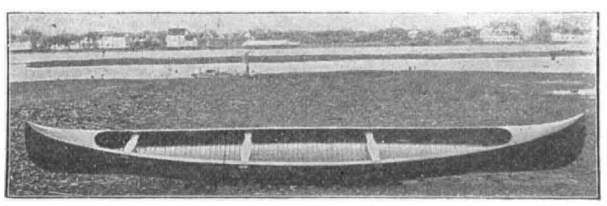

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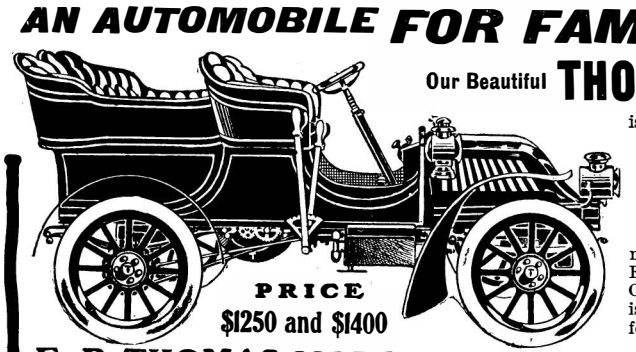

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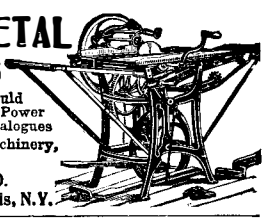

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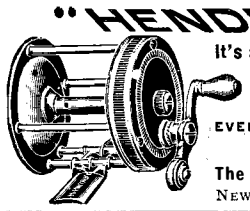

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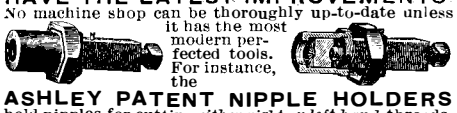

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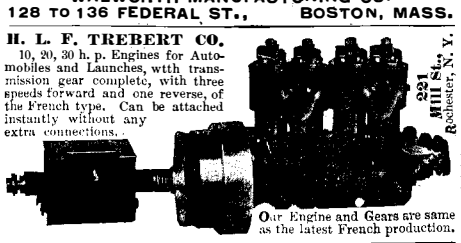

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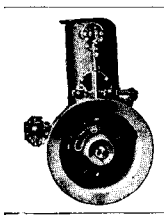

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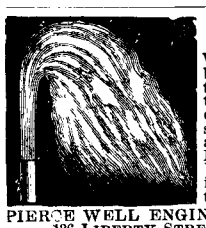

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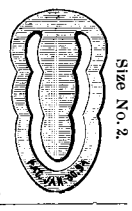

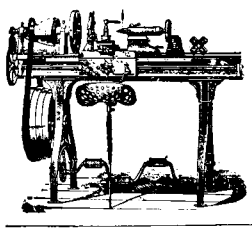

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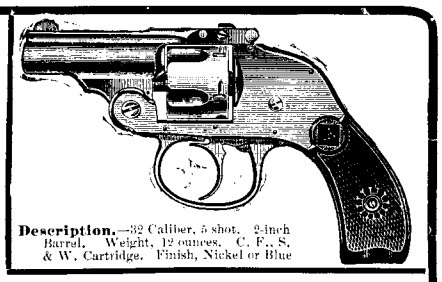

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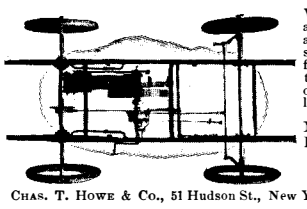

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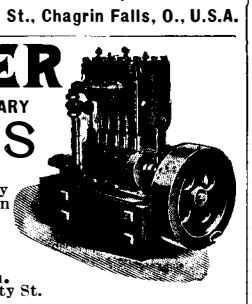

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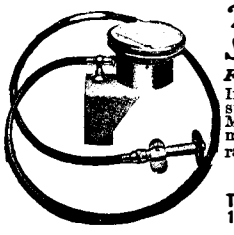

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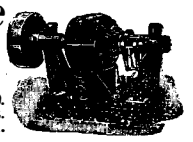

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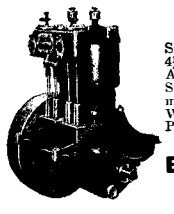

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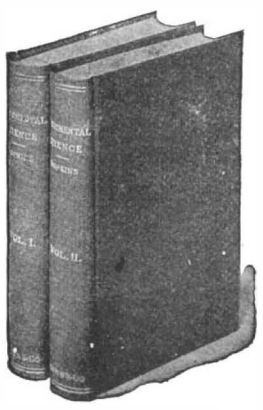

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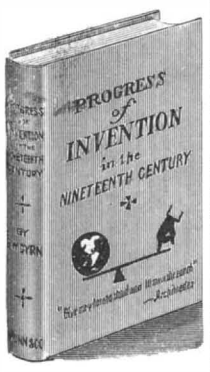

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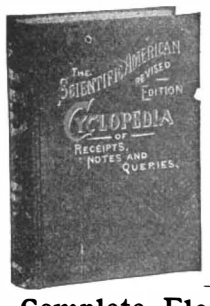

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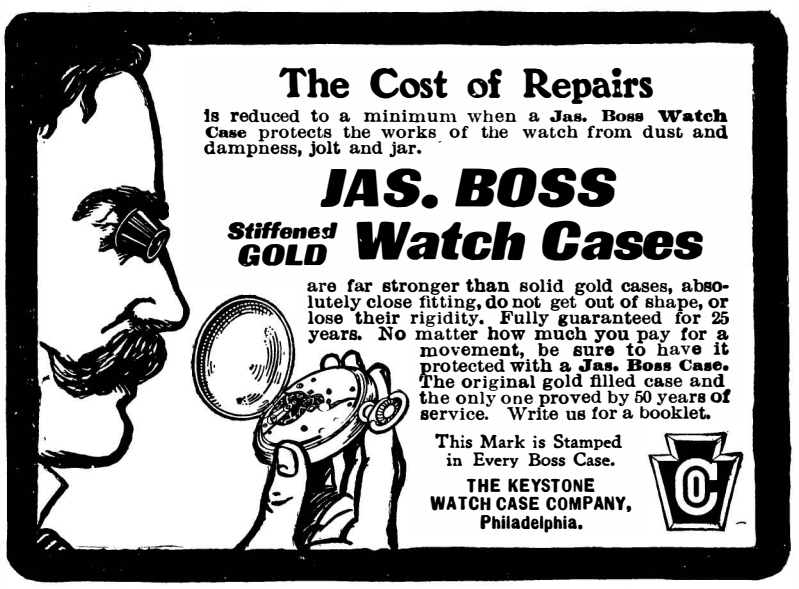
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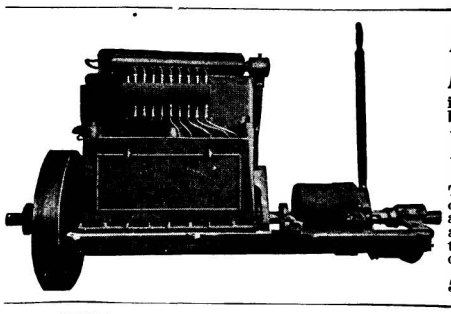

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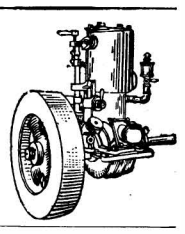

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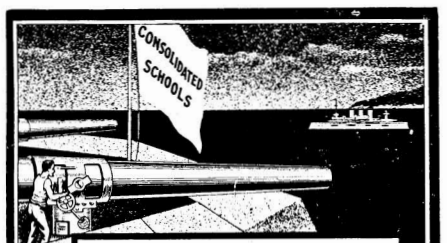

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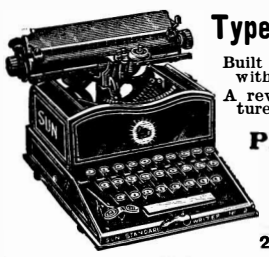

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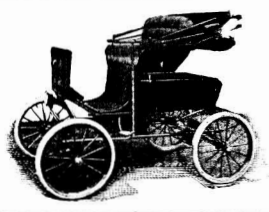

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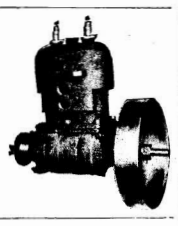

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DESIGNS.

Badge, E. E. Bower	36,254
Bottle, C. C. Bonnert	36,262
Button or similar article, C. A. L. Totten	36,255
Dish, G. C. Thiesen	36,259
Dish, salad, G. C. Thiesen	36,258
Dish or similar article, covered, C. J. Ahrenfeldt	36,257
Display fixture for stores, H. G. Roth	36,267 to 36,271
Picture frame, R. Benziger	36,256
Pillow cover, sofa, N. Y. Hamilton	36,272
Plate or similar article, G. C. Thiesen	36,260
Plate or similar article, C. J. Ahrenfeldt	36,261
Stool, C. D. Orcutt	36,263 to 36,266

TRADE MARKS.

Apparrel, certain named wearing, Rose Mfg. Co.	39,995
Apparel, certain named wearing, Wetzel	39,996
Bluing, Sawyer Crystal Blue Co.	40,026
Canned vegetables and fruits, Portland Packing Co.	40,000
Chocolate, cocoa, and preparation of chocolate and cocoa, L. A. Roberts & Co.	40,010
Clam preparations, certain named, Rosenstein Brothers	40,001
Cloaks, ladies', Hart & Shepard	39,993
Cognac, I. Sauvion	40,012
Collars, shirt, G. P. Ide & Co.	39,997
Confections, certain named, Russ, Suchard & Co.	40,008
Cotton goods, certain named, W. R. Grace & Co.	39,999
Dusters, feather, S. Levy	40,030
Facial massage cream and skin food, Cleopatra Manufacturing Co.	40,022
Fatty, oleaginous, or unctuous substances, prepared, Wesson Co.	40,004
Food and medicine in powdered form, horse, cattle, and poultry, Herb Medicine Co.	40,007
Food composed of wheat, oats, and barley malted, Twin City Nut Food Co.	40,005
Food, malted wheat flake, R. T. Davis Mill & Mfg. Co.	40,006
Gems, jewels, and precious stones and imitations thereof, Raystone Jewel Co.	39,992
Lifting jacks, Templeton, Kenly & Co.	40,032
Liquors, certain named malt, J. & P. Baltz Brewing Co.	40,011
Machines, certain named, Disser Syndicate	40,031
Meats, cured, Cudahy Bros Co.	40,003
Medical compound for external use, E. V. Feller	40,016
Medicinal tonic, Gorah Co.	40,014
Medicines for pulmonary and bronchial affections, J. E. Fitzgerald	40,017
Milk, condensed, Cold Process Co.	40,009
Oysters, Toke Point Oyster Co.	40,002
Perfumery, Frederick Stearns & Co.	40,021
Photographic baths, chemicals for, Chemische Fabrik Helfenberg A. G. vorm. Eugen Dieterich	40,027
Pills and pellets for certain named diseases, F. W. Gregg	40,018
Publications, certain named, P. F. Collier & Son	39,991
Remedies for certain named diseases, G. W. Conklin	40,015
Soap for use in shaving, substitute for, E. L. Mayo	40,023
Soap powder and laundry soap, Lewis Bros.	40,025
Soap, white laundry, W. G. Crane	40,024
Suspenders, Lobel, Coleman & Marcus	39,998
Tablets, anodyne, Fraser Tablet Co.	40,020
Tablets, dyspepsia, United Drug Co.	40,019
Undergarments, women's woven, Diclhemn Mfg. Co.	39,994
Varnish, fluid for removing, J. Seymour	40,028
Varnishes, Tousey Varnish Co.	40,029
Vehicles, self propelled, Buckmobile Co.	40,033
Whisky, Edward & John Burke, Ltd	40,013

LABELS.

"Bebe," for cigars, J. Bels	9,858
"Black Beauty," for hosiery, Johnston & Larimer D. G. Co.	9,842
"Cool Temperature," for lager beer, Stroudsburg Brewing Co.	9,855
"Dr. Rewalt's R. Q. R.," for a medicine, Dr. Rewalt Medicine Co.	9,843
"Electronaris Table Water," for water, Electro Sterilizing Co.	9,852
"F. P. C. Wax," for wax, Flame Proof Co.	9,867
"Kerr's Cough Drops," for cough drops, H. B. Kerr	9,846
"Ki Ki," for smoking tobacco, S. T. Nowlin	9,859
"Lockyer's Chili Peka Seasoning," for seasonings, F. H. Lockyer	9,851
"Monopole Brand," for canned strawberries, Wadhams & Kerr Bros.	9,850
"Nervorina," for a medicine, E. E. Holt	9,844
"Old Stock Beer," for lager beer, Stroudsburg Brewing Co.	9,854
"Parsve Crackers," for crackers, H. Baldinger	9,848
"Peak Fine," for cigars, A. C. Henschel & Co.	9,857
"Pheasant Brand Splits," for mineral water, T. F. Mackmiller	9,853
"Ponquace Wrinkle Remover," for a toilet preparation, Le Grande Mfg. Co.	9,847
"Remarkable Old Scotch Whiskey," for whiskey, J. Gillon & Co.	9,856
"Rex," for ginger ale, W. A. Megrath	9,865, 9,866
"Rex," for lemon soda, W. A. Megrath	9,861, 9,862
"Rex," for sarsaparilla, W. A. Megrath	9,863, 9,864
"Rippen's Mixture," for smoking and chewing tobacco, H. Rippen	9,860
"Simon's Aromatic Stomach Bitters," for stomach bitters, S. B. Schein	9,845
"Umatilla," for canned plums, Oregon Packing Co.	9,849

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"Dressing for Dinner," for salad dressing, H. A. Thomas & Wylie Lithographing Co.	639
"Jet-a-Lac," for an enamel, John Wahl Paint & Color Co.	641
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"Mosquito Quits," for insect eradicator, L. D. Cooley	640

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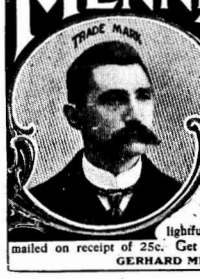

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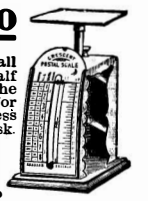

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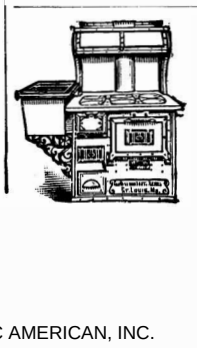

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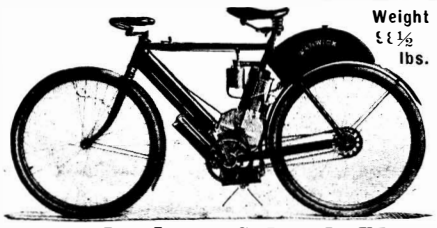

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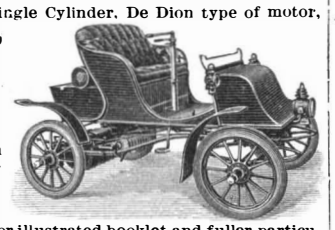

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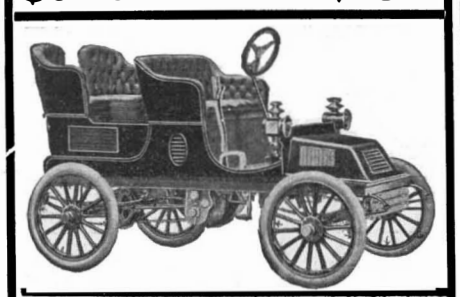

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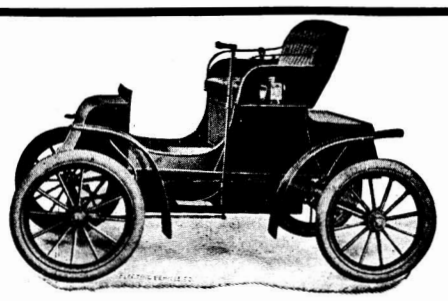

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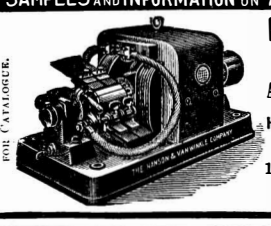

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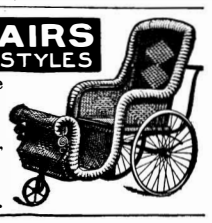

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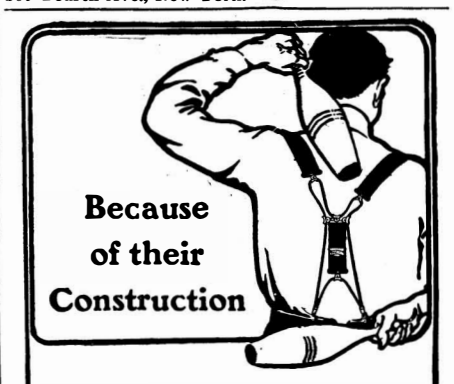

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